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State of Illinois

JAMES R. THOMPSON, GOVERNOR

STRATEGIC COMMUNICATIONS NETWORK PLAN

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Prepared

June 9, 1987

by

Network Strategies, Inc.
Fairfax, Virginia 22030

CMS

ILLINOIS DEPARTMENT OF

CENTRAL MANAGEMENT SERVICES

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EXECUTIVE SUMMARY

Today's communications environment has been complicated by the divestiture of AT&T, rapidly advancing technology, changing regulatory policy, and an increasing number of service offerings. Individually, agencies have met their own requirements by using digital technology, network management systems, and advanced network architectures. This environment, however, gives large users of telecommunications, like the State of Illinois, the flexibility to implement more cost-effective solutions to support most of the State Agencies' missions.

Recognizing these opportunities, the Department of Central Management Services engaged Network Strategies, Incorporated (NSI), to write a Strategic Telecommunications Network Plan with the assistance of the Blue Ribbon Committee (a select committee of government, university, and private industry representatives), State Agencies, and the State's telecommunications vendors. This document is the result of that effort.

NSI performed an extensive requirements analysis that identified the following characteristics of the State's current communications environment:

- The State has a complex voice network consisting of 10 major switching systems and over 200 tie-lines. In the current voice environment, users make all routing decisions, and therefore must remember all the appropriate dialing procedures for using long-distance services.

- The State has six major, independent data networks, which support over 1000 leased circuits and over 6000 terminal locations. User surveys indicate data traffic is growing at an annual rate of 30%. The State's major data communications environment is based on IBM's Systems Network Architecture (SNA), although several major State agencies do not use IBM equipment.

- There is no current statewide intercity video network, but local video systems exist within university campuses or major metropolitan areas. General statewide video distribution requirements are just now beginning to emerge.

We made recommendations in two areas, network architectures and network management. These recommendations are summarized below.

The State should implement a statewide transmission facilities "backbone" consisting of high-speed digital transmission facilities connecting four major nodes, Springfield, Chicago, Champaign/Urbana, and Carbondale. Smaller nodes connect to one of these four nodes using lower-speed digital facilities. This backbone has sufficient capacity to carry the State's projected five-year voice and data traffic. Depending on the choice of video technology, this backbone may also be able to carry the State's projected video traffic.

We recommend the State perform a pilot test for video that will allow the State to finalize emerging video requirements. Based on our current understanding of the requirements, we recommend that the State implement a video network using conference grade video technology. This technology uses transmission facilities that are easily accommodated on the proposed digital backbone. If requirements for higher-quality video emerge, the State should implement television network quality video through the use of additional high-speed transmission facilities or through the use of satellite technology.

The State should implement a transparent uniform numbering plan (TUNP) voice network, which will allow the State to take advantage of inexpensive on-network voice communications and simplified dialing procedures while eliminating the requirement to maintain a separate numbering plan (i.e., directory) different from the public telephone network. A TUNP will enable State users to dial the number published in the public telephone directory to call any State location. Inter-state long-distance traffic should be concentrated to a limited number of sites for improved bulk long-distance calling rates.

The State's data communications networks should be accommodated via two parallel data networks. The first is based on CMS's existing SNA data network, and the second is based on a new X.25 packet switching network. X.25, an international standard for connecting data terminals and hosts to packet switching networks, is widely accepted as the common standard for non-SNA data communications. We recommend a gradual implementation of the X.25 data network. During the migration period to X.25, non-IBM systems can be supported on the backbone simply by sharing high-speed digital transmission facilities. We also recommend that the State eventually implement additional data communication standards, such as those being defined by the international and national standards organizations. These standards will simplify intercommunication of computer and communication equipment from multiple vendors.

The State must consider the following four areas when evaluating management approaches:

- Ownership of transmission facilities
- Systems integration responsibility
- Operations of the backbone network and end-user systems
- Procurement strategies

We recommend the State procure services rather than install its own transmission facilities. The State should install transmission facilities only where very large, short term cost savings will be realized, or where the State requires a guarantee of performance better than that available using carrier services.

We recommend the State take responsiblity for systems integration. Nevertheless, the State should contract with a systems integrator to perform the installation of the technical recommendations. This approach will allow the State to remain in control of the integration process without requiring a large recruiting effort. By using a systems integrator, the State can avoid substantial staff increases for a short-term implementation activity.

We recommend the State centrally manage the underlying transmission facilities backbone, video switching equipment, voice switching systems, and the primary data switching system (including X.25 packet switches). State agencies requiring data transmission services can either obtain transmission facilities from the State's network manager or rely on the State network to provide total network service. In either case, the user agency retains responsibility for its host environment, and any locally attached terminals. Remote terminals may be part of the centralized network or they may operate in a separate data network.

We recommend the State bundle the procurement of transmission facilities, associated multiplexing equipment, and systems integration support required to implement them. We further recommend the State include several options to the backbone procurement, including the X.25, SNA, and video networks. By including these networks as options to the procurement, the State has the flexibility to accept different vendor's proposals for each option, or accept none of the offered optional proposals. This approach allows the State to exploit the competition available in the telecommunications market to obtain attractive cost savings while shifting the technical and financial risk away from the State to the bidder. This procurement approach also spurs the development of digital transmission facilities and new network services to locations in the State of Illinois that probably would not have seen these capabilities for over a decade.

We recommend the State establish a permanent steering committee responsible for guiding the State's long term communication strategy . This committee will guide the State in future planning issues such as growth, new technology, and major network upgrade.

We have identified eight "tracks" of activities to guide the State to a successful implementation of the target network architecture and management structure within two years:

- **Coordination and Planning** - the implementation of a Steering Committee and a Coordinated Planning Group to oversee the activities related to communications planning and procurement in the State

- **Voice Network Optimization** - the optimization of the current voice network to improve the State's short term cost savings until the backbone transmission facilities are implemented

- **Backbone Procurement and Implementation** - the implementation of a state wide high-speed transmission facilities network, which can be used to support voice, data, video, and radio services

- **TUNP Voice Network** - the implementation of a statewide voice network with simplified, standard dialing procedures and sophisticated switch capabilities.

- **Video Network Pilot Test** - the pilot test of a state-wide video network to identify the State's emerging video requirements

- **Metropolitan Area Network Design and Implementation** - the redesign of the current data communications networks supporting the Springfield and Chicago areas, to take advantage of more cost-effective transmission facilities and recent changes in tariffs

- **ISDN and SS#7 Pilot** - the testing of new voice switching protocols to position the State to take advantage of new and enhanced voice service offerings as they are developed

- **Multivendor Application/OSI Pilot** - the testing of new data communications standards to explore the possibility of simplifying communications among the multiple computer vendors represented in the State.

If the State aggressively pursues these activities, it will strategically position itself to take advantage of new technologies, improve the communications services it offers to State agencies, leverage its investment in existing equipment, and improve the level of service the Illinois business community receives.

The expected costs and savings for the eight projects are described below:

- Coordination and Planning - The State will spend approximately $115,000 in the first year and $57,000 in later years to support this task. No direct cost savings are achieved.

- Voice Network Optimization - The State will spend approximately $84,500 in the first year. The expected cost savings are 5 to 10% of current switched facility costs or approximately $150,000 to $300,000 annually.

- Integrated Backbone Network - The State will spend approximately $413,500 in the first year. The expected cost savings are approximately $62,000,000 over the lifetime of the five-year plan. Cost savings in the first year after implementation are expected to be $6,000,000. Further cost savings accrue in later years because of network growth and increases in tariff costs.

- TUNP Voice Network - The State will spend approximately $19,500 per year over the five-year plan. These costs represent personnel costs only. According to AT&T and Northern Telecom, no additional voice switching equipment will be required to support the TUNP voice network. The expected cost savings are approximately $3,500,000 over the lifetime of the five-year plan.

- Video Network Pilot - The State will spend approximately $23,000 in the first year. There are no cost savings because the State does not currently operate inter-city video systems.

- Metropolitan Area Network - The State will spend approximately $224,000 in the first year. Expected cost savings are approximately 20 to 50% of current transmission facility costs in major metropolitan areas.

- ISDN and SS#7 Pilot - The State will spend approximately $288,190 in the first year. The State will drastically reduce the cost of inappropriate switch purchases or the State will reduce the possibility of obsoleting switches that are procured in the next five years.

- Multivendor Application/OSI Pilot - The State will spend approximately $162,500 in the first year. From the knowledge gained in this pilot the State can improve overall interoperability of different computer systems in different agencies.

Acknowledgement

This Strategic Communications Network Plan represents the result of extensive efforts of many people. To the State Agency, University, and vendor personnel too numerous to mention by name, please accept our sincere appreciation.

We offer our particular thanks to the members of the Advisory Committee who, serving as the consensus body, provided incisive and timely guidance throughout this project.

Michael E. Tristano

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1.0 INTRODUCTION

1.1 BACKGROUND

The State of Illinois uses telecommunications and networking to support the requirements of over 100 State agencies, departments, and commissions, which are responsible for providing support services to 12 million residents in 102 counties in the State of Illinois. Although State agencies serve sites in the same proximity, sometimes agencies do not coordinate the acquisition of telecommunications service. Although it simplifies the operation of individual agency's networks, this lack of coordination sometimes leads to inefficiencies in telecommunications.

State agencies are facing problems of rising communications costs, rapidly advancing technology, and tracking the ever changing vendor marketplace. With aggregate yearly expenditures of over $95,000,000 in voice, data, and radio communications, the State of Illinois can leverage its spending power to get better and more cost-effective service and enhance the service provided to residents. The number of possible activities is large; the state must focus its efforts on those that promise the best return on investment.

Faced with this situation, the State has created a coordinated overall structure to provide for State communications management. The State identified the following goals for this organization:

- Employ economies of scale, wherever possible
- Utilize competitive bids, bulk purchases, and master contracts, where appropriate
- Assure system and equipment performance in compliance with agency expectations
- Maximize network effectiveness and savings through open systems design approaches
- Assure a continual response to agency programmatic needs

Under the direction of the Department of Central Management Services (CMS), a Blue Ribbon Committee (BRC), and a working committee, Network Strategies, Inc. (NSI) was tasked to develop a five-year Strategic Communications Network Plan that would meet the needs listed above. This report is the result of that planning effort.

1.2 METHODOLOGY

Figure 1-1 illustrates the methodology used to develop the the Strategic Communications Network Plan. The activities are grouped into the following four categories:

- Needs and technology assessment
- Architecture alternatives analysis
- Management alternatives analysis
- Transition plan

Each of these four major activities is discussed in the following paragraphs.

The needs assessment approach used by NSI in this study included user surveys to identify each department's existing and future communications requirements and agency interviews to augment the survey information. This information resulted in the identification of major system requirements, baseline systems, and traffic matrices of voice, data, and video services. NSI reviewed all of the conceptual designs submitted by the communications vendors participating in the development of the Strategic Communications Network Plan. In addition, NSI attended technical presentations made by IBM, WANG, DEC, AT&T and Northern Telecom.

From the needs assessment and the traffic analysis, NSI selected appropriate network architectures for further analysis. The network architectures analysis included transmission facilities, voice network services, data network services, and video configurations. We analyzed each of the various alternatives and recommended a solution for each network service.

Based on the selected network architecture, NSI evaluated the various management and procurement options. We analyzed issues of ownership, systems integration, operation, and procurement and made recommendations concerning the most appropriate alternative.

In the final phase, NSI developed a five year transition plan for all network services. Included in this five year plan are all the major tasks for successful implementation of the recommendations and a first-year budget.

1.4 STRUCTURE OF THE REPORT

Following this introduction are four Chapters and six Appendices. Chapter 2 describes the Needs Assessment including the approach used to collect requirements information with user interviews, department surveys and development of Figure 1-1

METHODOLOGY

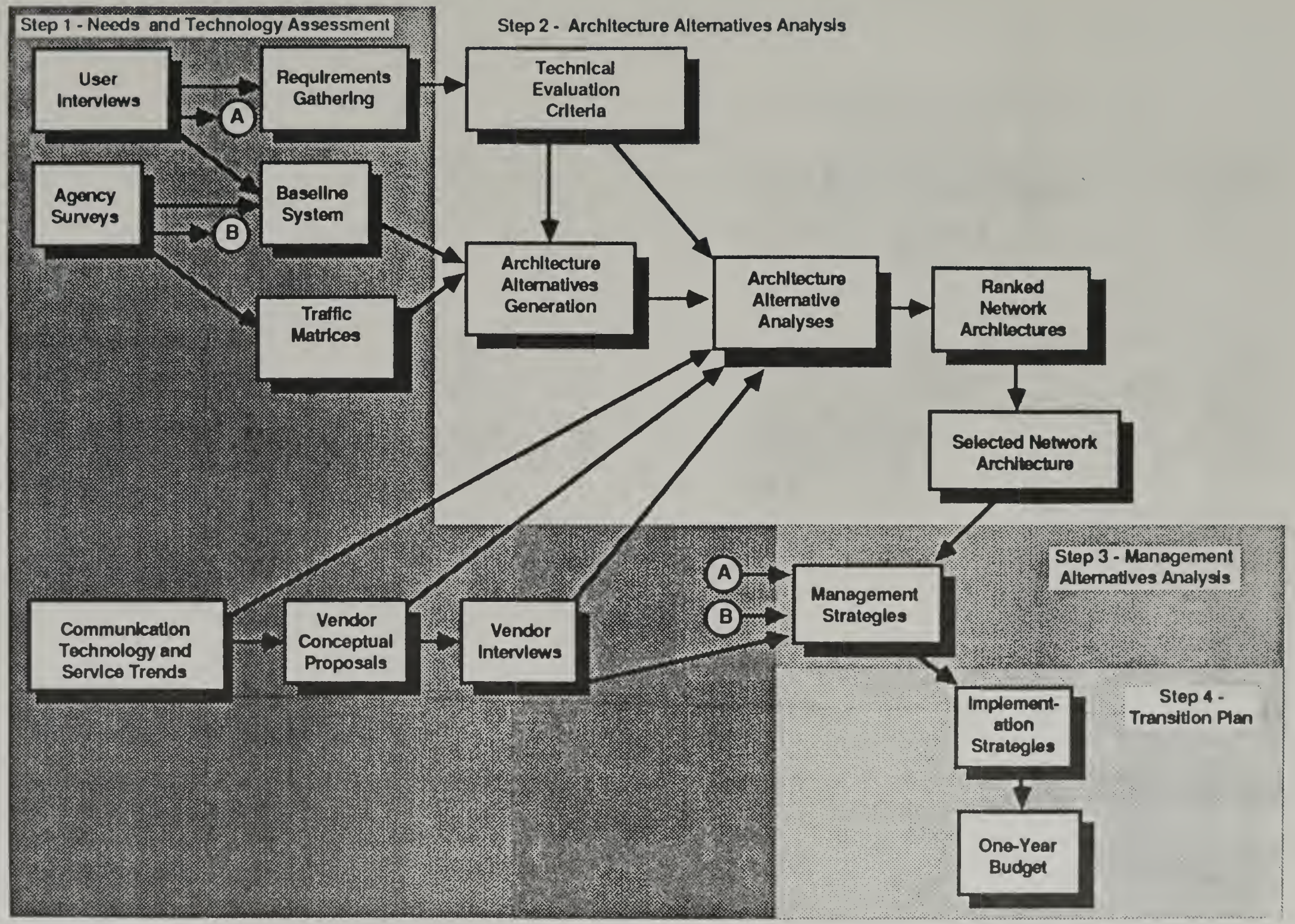


Figure 1-1

communications traffic matrices. Chapter 3 describes the Architectures Analysis, including transmission facilities, voice networks, data networks, video networks, and potential additional cost savings that would be available after the recommended network architecture is implemented. Chapter 4 describes the Management Analysis, including ownership of facilities and equipment, systems integration responsibilities, system operation, and procurement strategies. Chapter 5 describes the Transition Plan including the required steps from the current network architecture to the recommended network architecture and a first year budget estimate.

The contents of each of the appendices is summarized below:

A — Interview Summaries
B — Supporting Documentation
C — Survey Summaries
D — State Voice Switching Systems
E — Data System Summary
F — Traffic Matrices

2.0 NEEDS ASSESSMENT

Chapter 2 describes the activities performed and the results of the needs assessment process. The needs assessment included conducting interviews with agency representatives, surveying agencies, bureaus, and commissions within State government, reviewing documentation provided by the State, and interviewing major vendors that provide service to the State. The following sections list the organizations that were interviewed, describe the interview agenda, describe the survey results, present an overview of agency requirements for voice, data and other communications facilities, and the last section concludes with a summary of services to be provided.

2.1 AGENCY INTERVIEWS

NSI personnel conducted interviews with personnel in the following agencies:

- Central Management Services
- Department of Child and Family Services
- Department of Commerce and Community Affairs
- Department of Mental Health
- Department of Public Aid
- Department of Transportation
- Illinois State Lottery
- Illinois State Police
- Office of the Attorney General
- Secretary of State Police
- Southern Illinois University
- State Board of Education
- University of Illinois

The results of the agency interviews are presented in Section 2.3. Appendix A contains a description of each of the interviews.

NSI used the following interview agenda during the interviews.

- State agency functions and mission — What are the agency's mission and support responsibilities?

- Significant existing communications requirements for various types of network facilities — What existing services are used to support agency mission activities and what is the relative importance of each

type of communication service to the agency? In particular the following services were discussed:

- Voice Systems
- Data Systems
- Video Systems

- Networks required to satisfy the preceding systems requirements — What systems are used to provide the services required by each agency? In particular the following systems were discussed:

  - Dial-up message-switched networks — What kinds of dial access lines are used to process intercity calls within and between agencies and to and from citizens of Illinois?

  - Dedicated leased lines — How many leased lines does the Agency Utilize? To which major Illinois cities are the lines connected? What type of equipment is connected to the lines? What kinds of messages or traffic are transported? Are there any requirements for tandem switching and multiple system connectivity?

  - Microwave facilities — Where are the transmitters and relay facilities located? What frequencies are assigned? Which agencies are served? What applications are performed? Is the microwave network analog or digital, is the network a backbone facility or is it a collection of miscellaneous links to selected geographical areas? How much capacity is used? How old is the network? When was the last addition made? Are there any significant problems with the network?

  - Fiber optic facilities — Are there any fiber networks currently installed? How many fiber networks are there, and what cities do they serve? What type of applications does the fiber network carry, and is the network shared among different agencies? What type of equipment is connected to the fiber network, and how much existing capacity is used?

- Future changes to existing networks — What existing or new applications do you plan to migrate/add to the current networks? What is the nature and extent of the change required to the network to enable the addition of these applications?

- Significant new communications requirements — What kinds of changes are currently planned? Which current systems or applications will be affected? Will the new requirements involve a significant procurement of new equipment?

- Communication and interaction with other State agencies — What interconnection requirements exist between agencies and how do agencies presently satisfy these requirements?

Many agencies supplied documents, maps, network configuration diagrams, equipment listings, and other supporting information that was used in the analysis of the State's network requirements. A listing of the documentation received during the needs assessment process is contained in Appendix B.

The following vendors provided conceptual designs of statewide communications networks to the State:

- Advanced Business Communications
- AT&T
- DEC
- Illinois Bell Telephone
- Illinois Consolidated
- IBM
- MCI
- Northern Telecom
- US Sprint
- WANG

In these conceptual designs the vendors identified network approaches that the State could use to support its present and future telecommunications requirements. These designs provided further input to the analysis of different technical and management alternatives.

2.2 AGENCY SURVEYS

Survey forms were distributed to all agencies, departments and commissions. The survey, listed in Appendix C, contains five parts with specific questions about each agency's existing network and future network plans. The survey is summarized below.

- Part 1 — requests general user department information, city location, name, title, address and phone number of a contact person.

- Part 2 — requests information about existing DEDICATED intercity facilities and networks for each location.

- Part 3 — requests information about existing SWITCHED intercity services and equipment operating in each city.

- Part 4 — asks for information concerning plans for future DEDICATED intercity applications and requirements.

- Part 5 — asks for information concerning plans for future SWITCHED intercity applications and requirements.

Fifty completed survey forms were received from users throughout the state. Twenty-four of the fifty survey forms contained no significant network requirements or problems. All the other survey forms indicated only local requirements.

2.3 CURRENT VOICE NETWORK REQUIREMENTS

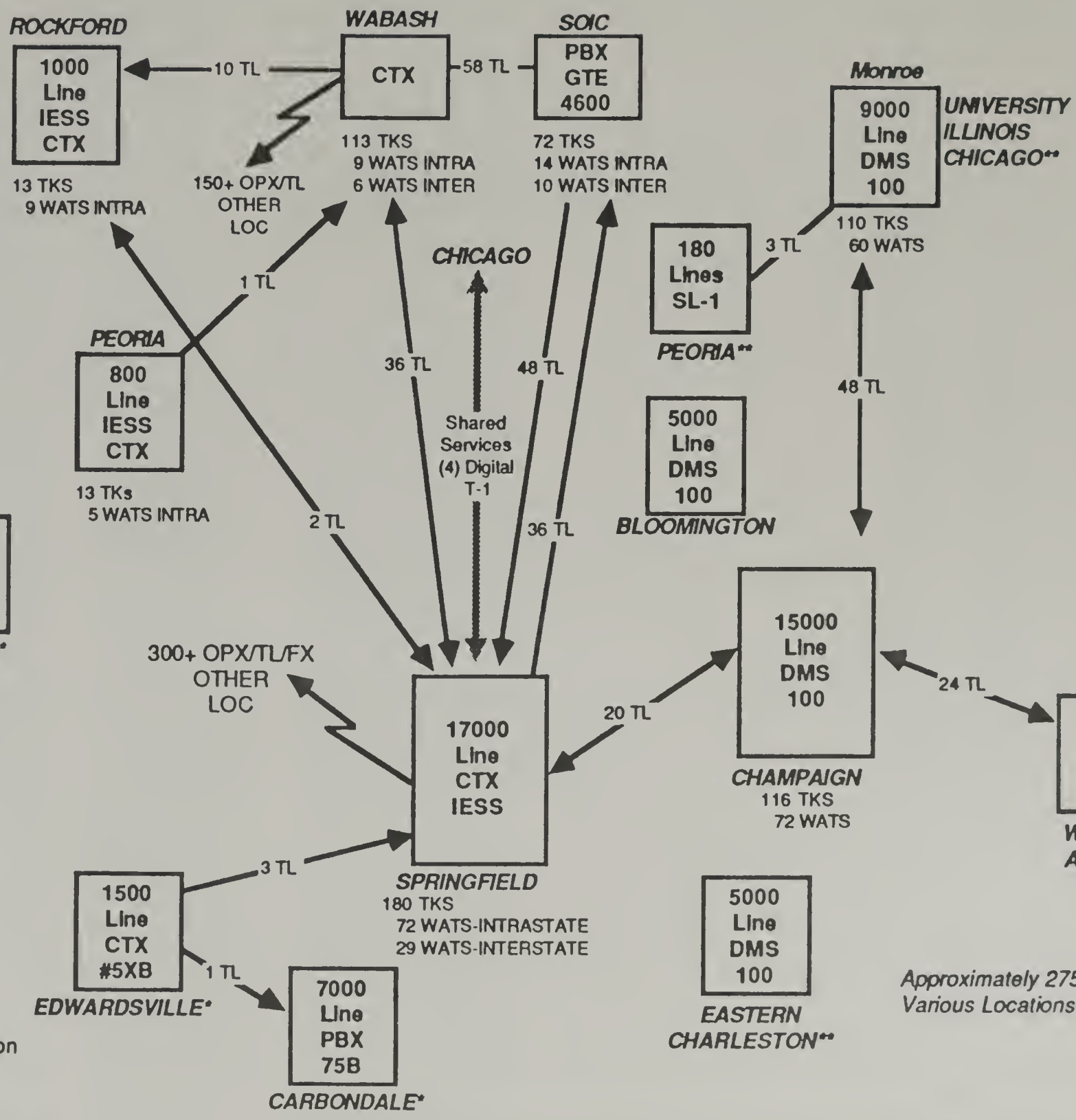
The state's current baseline voice network is illustrated in Figure 2-1. The following sections describe the baseline requirements for voice switching and voice network facilities requirements.

2.3.1 Voice Switching Requirements

The baseline voice network is configured as a combination of PBXs and leased Centrex services. The eight major Centrex systems are managed by CMS. The PBXs are managed by the individual agencies, except where there is a regional State government facility with multiple agencies. A listing of State PBX systems is contained in Appendix D. The list indicates the type of PBX, the city location, the state agency owning the system, the number of station lines, and the software generic on each system.

The State's current voice network is based on a Tandem Tie Trunk Network (TTTN). A TTTN requires the user to dial an access code (e.g., 127) to use an inter-machine trunk for communication between systems. With a TTTN the State does not have to maintain a statewide telephone directory, but users are responsible for dialing the correct digits and properly choosing when to use a dedicated circuit or a different service such as WATS or regular long-distance.

Illinois Baseline Voice Network



Network Strategies, Inc.

Figure 2-1

2.3.2 Voice Network Facility Requirements

Current voice network facilities consist of leased tie line circuits, T1 channels, foreign exchange circuits and WATS lines as shown in Figure 2-2. The State identified several problems in obtaining cost-effective digital connectivity in several locations throughout the state, such as Rockford and Carbondale.

2.4 CURRENT DATA NETWORK REQUIREMENTS

The State's current baseline data network is illustrated in Figure 2-3. The following computer vendor's products are used in the State:

- Burroughs
- CDC
- DEC
- Hewlett-Packard
- Honeywell
- IBM
- Sperry/Concurrent
- Univac
- Wang

The data networks supporting these computer systems are illustrated in Figures 2-4 through 2-9. The CMS data network is the largest system with 12,800 terminals, and the network is growing by 250 terminals per month. The State Lottery system is the next largest network with 3300 terminals, with network growth to over 15,000 terminals in the next five years. The Public Aid data network currently has 2000 terminals, and is expanding by 30% annually. The State also has data networks supporting Honeywell and Hewlett-Packard equipment.

The University of Illinois uses an IBM SNA network architecture for administrative and academic computing at its two remote data centers in Champaign and Chicago. The State universities have autonomous data processing systems and networks and do not share any significant community of interest or interconnectivity requirements with state agencies.

Many State agencies are connected through the CMS main computer center. A few agency data networks listed above do not have connectivity to each other or to the CMS data network. This lack of connectivity is creating problems for Law Enforcement and Transportation agencies in sharing information resident in computer data bases located on different systems. Many other agencies specifically noted the difficulty in connecting to different computer systems.

VOICE SYSTEMS
BICS/DOC

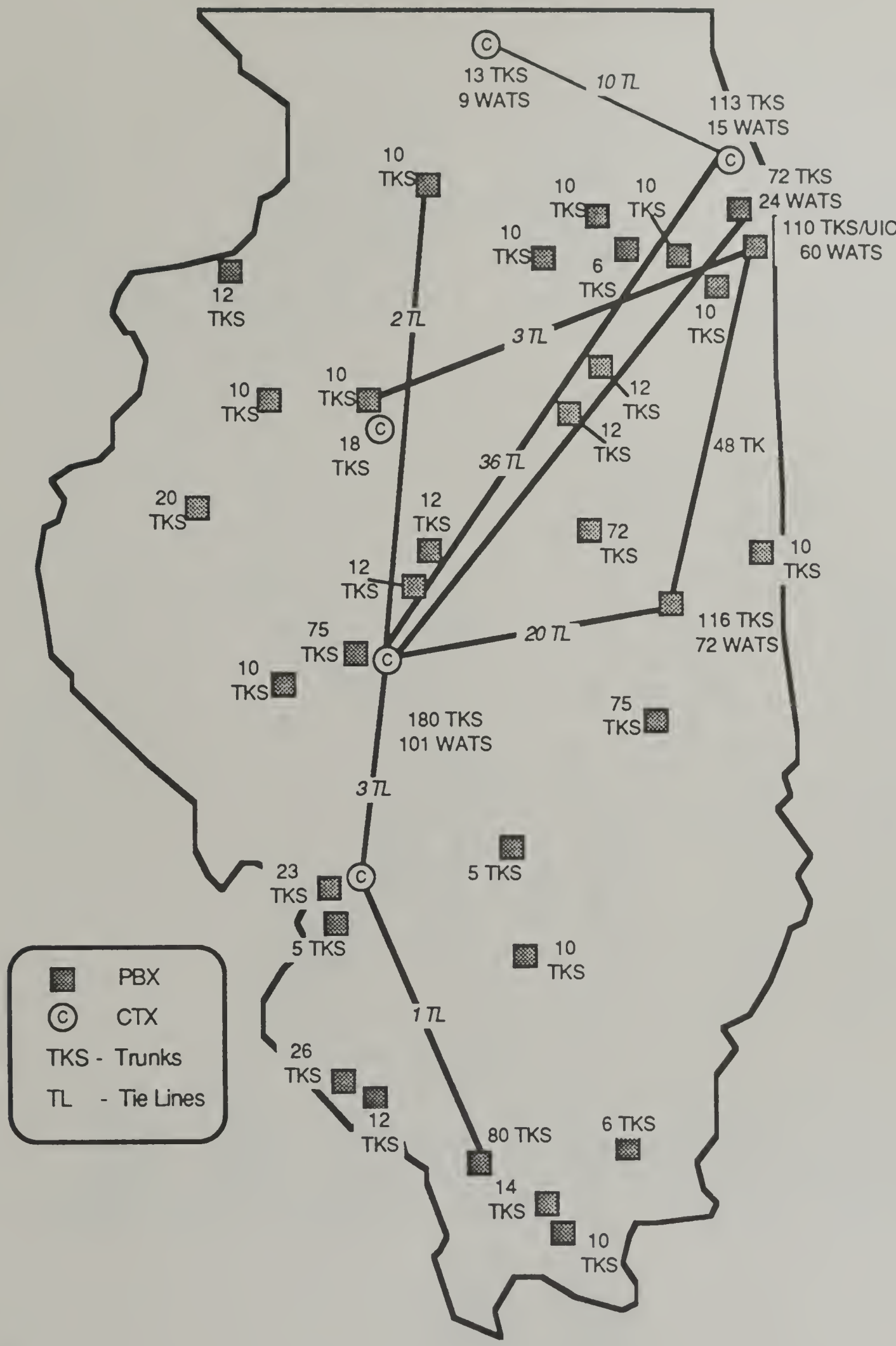


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Figure 2-2

Illinois Baseline Data Network

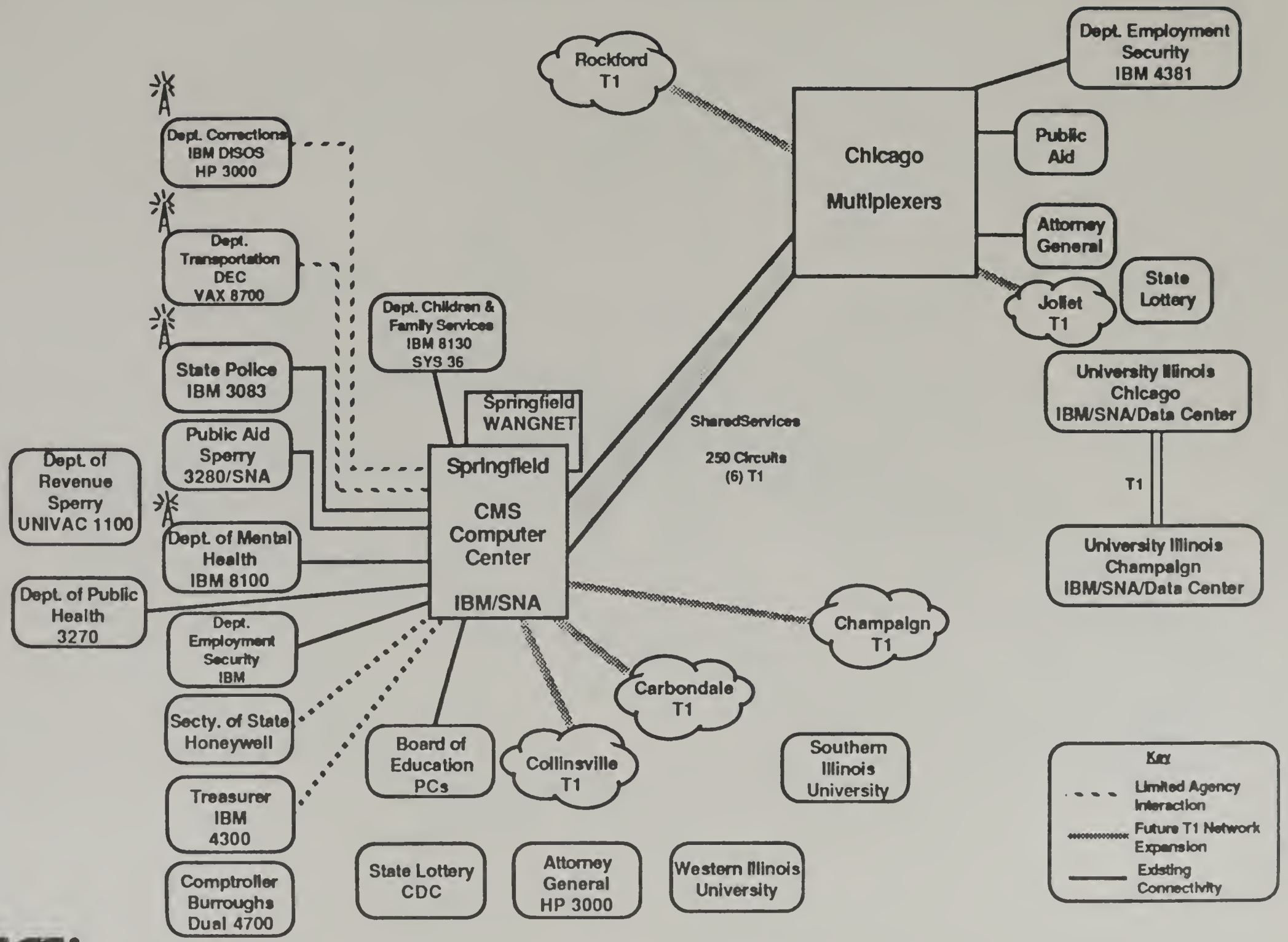

Figure 2-3

SNA DATA NETWORK
Central Management Services

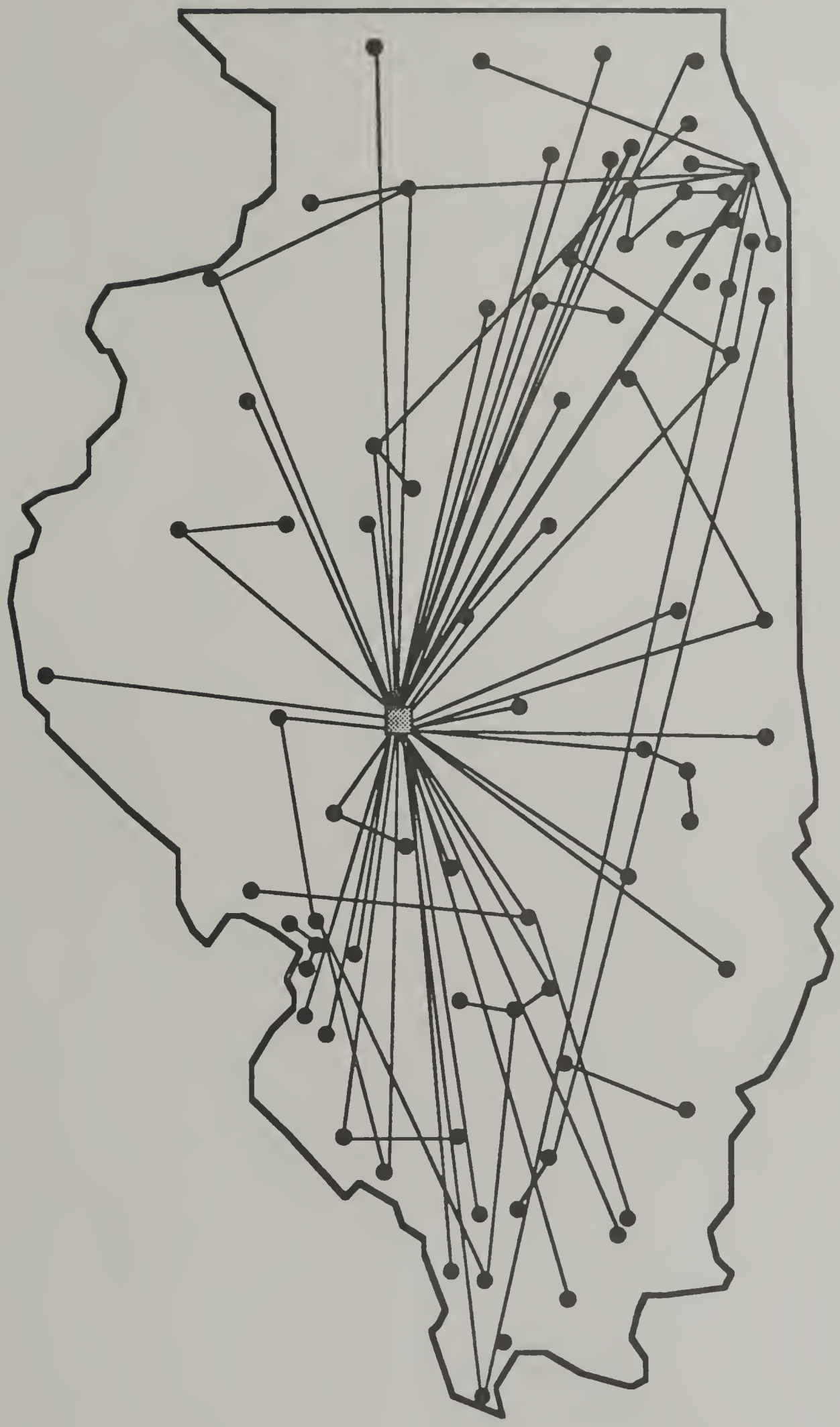

Figure 2-4

BISYNC DATA NETWORK
Central Management Services

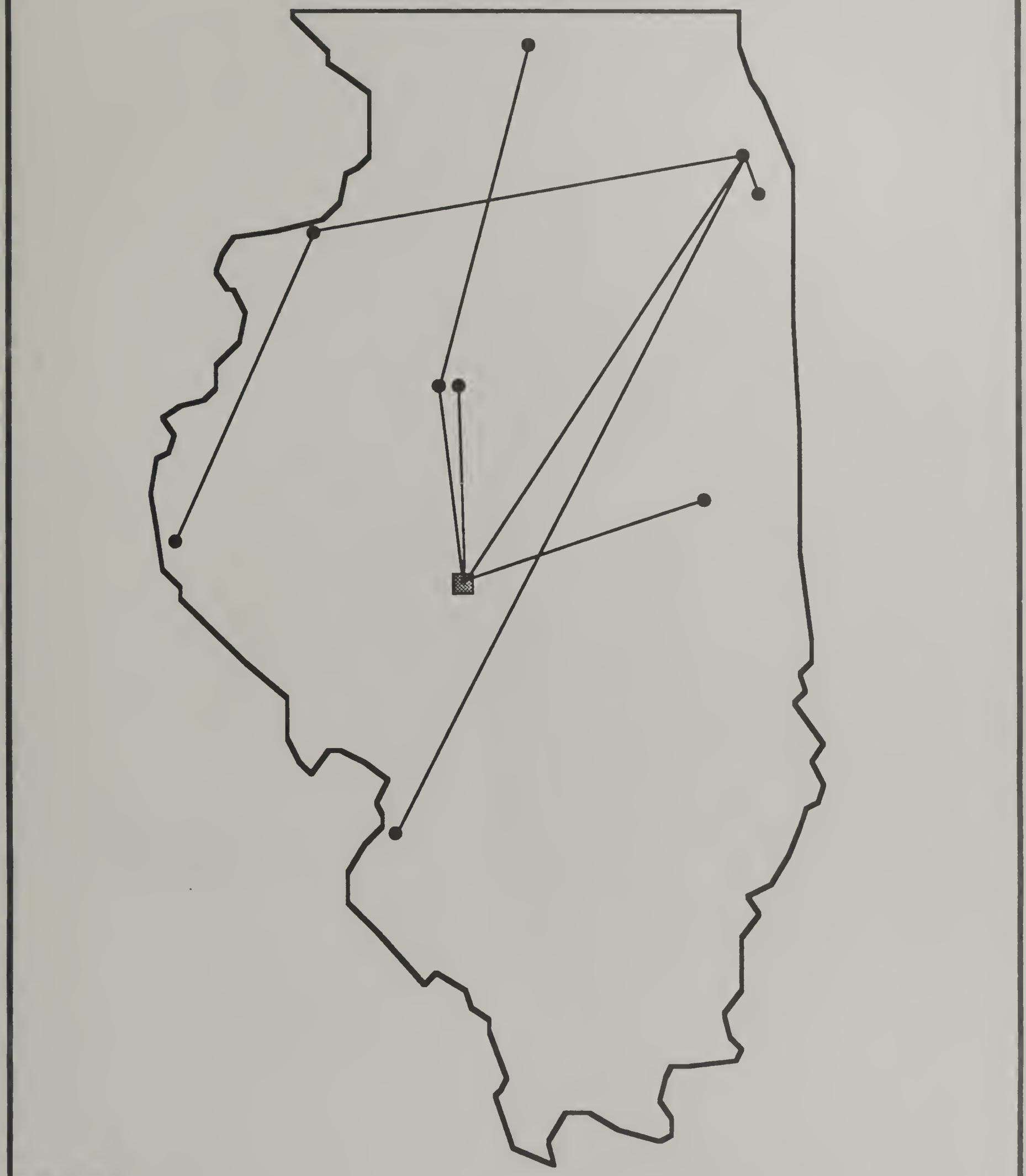

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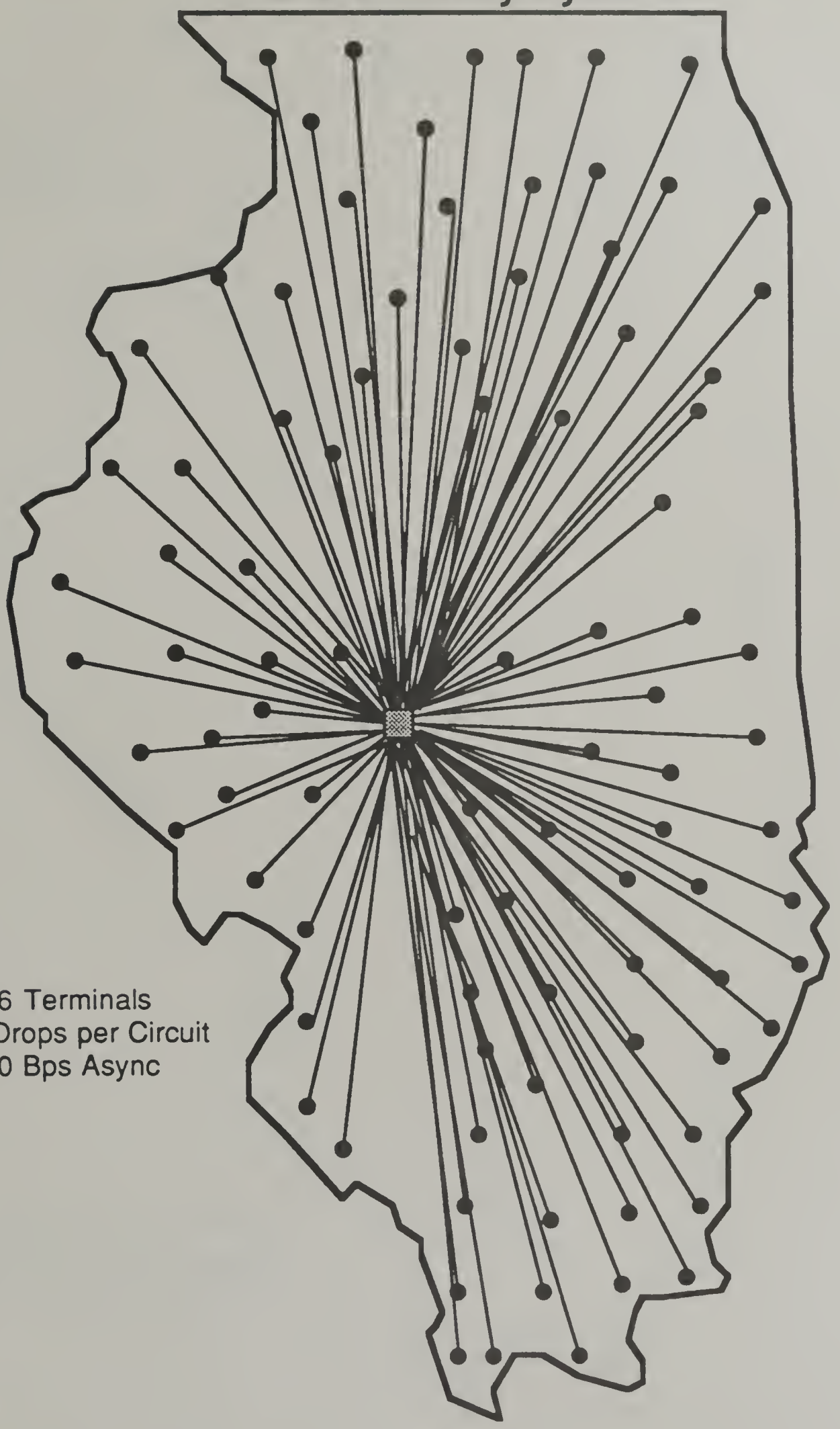
Figure 2-5

CONTROL DATA CORPORATION NETWORK
State Lottery System



3256 Terminals
15 Drops per Circuit
1200 Bps Async

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Figure 2-6

SPERRY DATA NETWORK
Department of Public Aid

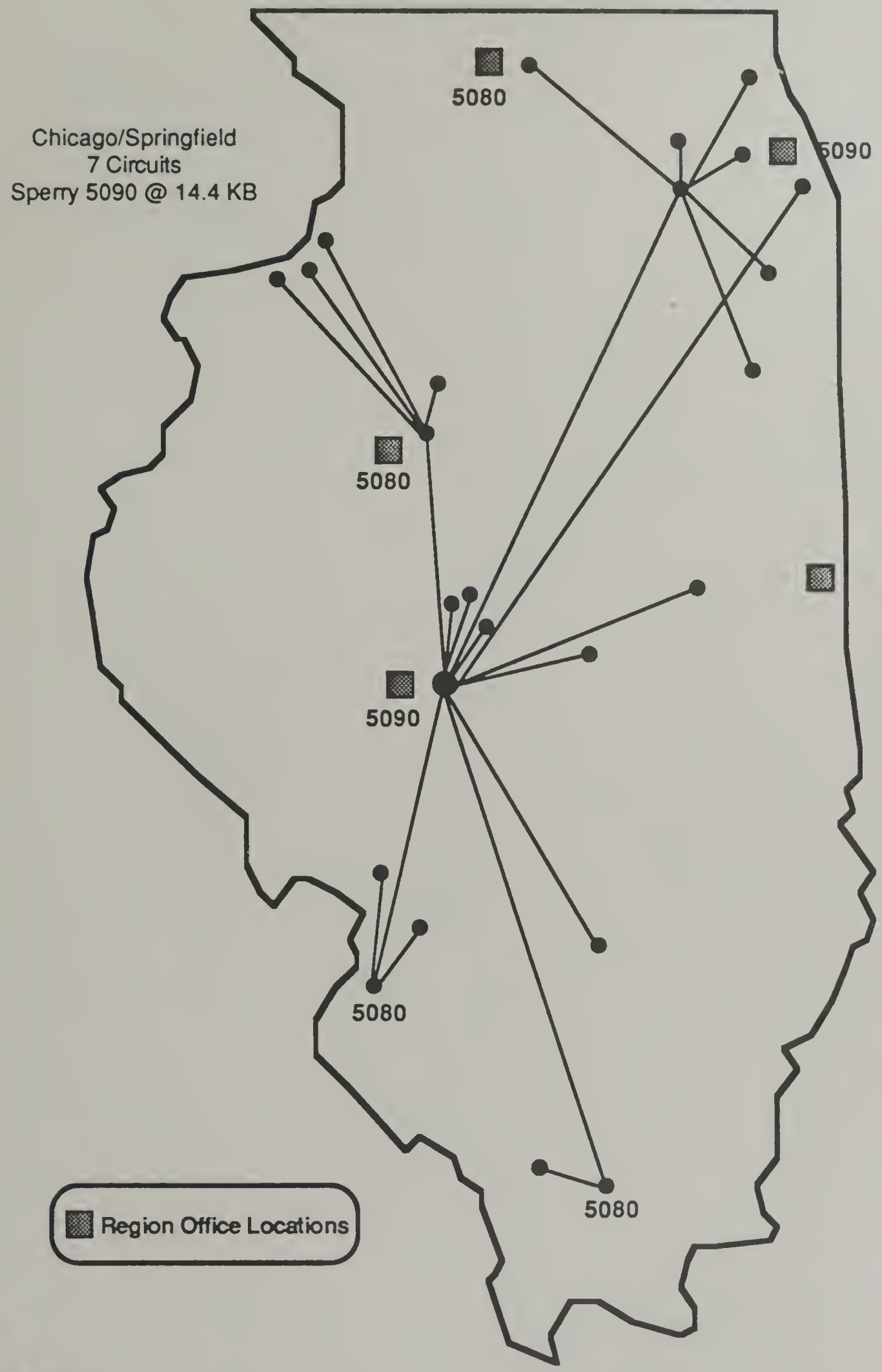

Figure 2-7

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ILLINOIS HONEYWELL DATA NETWORK
SECRETARY OF STATE

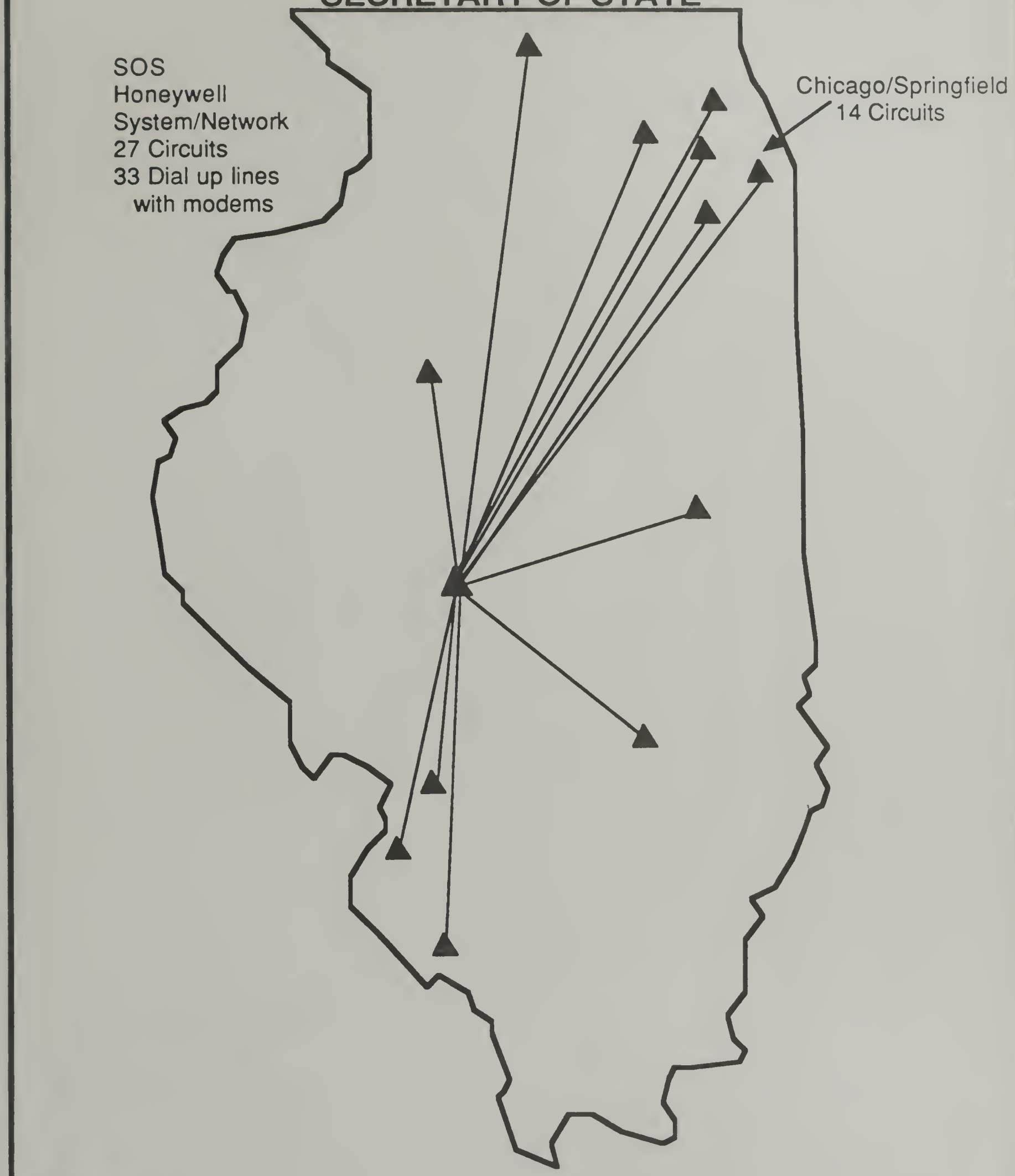

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Figure 2-8

ILLINOIS HEWLETT-PACKARD DATA NETWORK

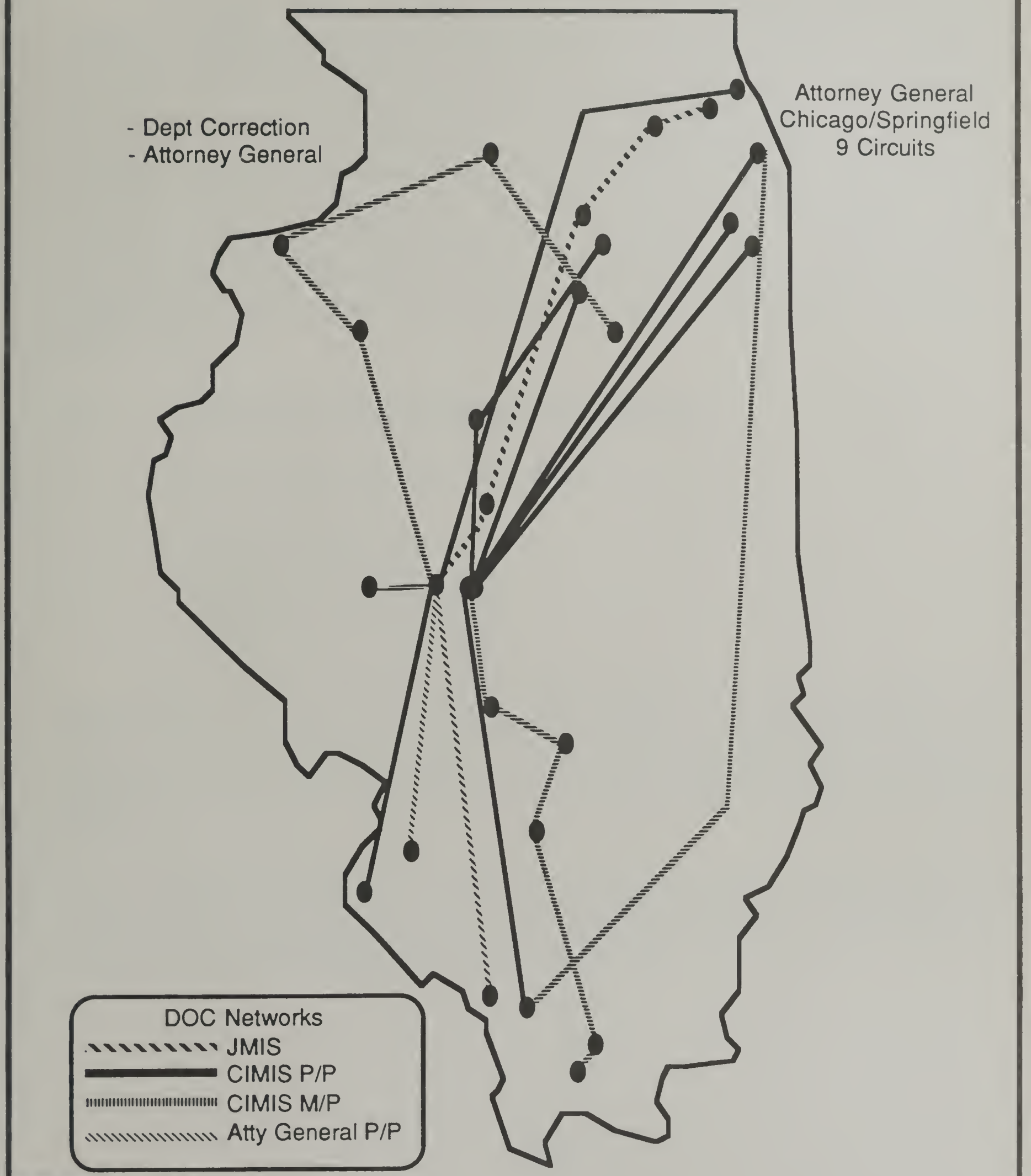

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Figure 2-9

2.5 CURRENT MICROWAVE TRANSMISSION FACILITY REQUIREMENTS

The States' microwave system consists of relay towers strategically located to support the police and transportation radio systems, as shown in Figure 2-10. There is currently no statewide microwave network. The State analyzed the costs of upgrading the current system to provide statewide telecommunications services, and determined this system would cost approximately 28.5 million. This cost included equipment and circuits but not technical engineering and network management support. The proposed statewide microwave network would run the full length of the State and connect universities at Carbondale, Springfield, Champaign, and Chicago. The network also features a Sterling to Jacksonville route to pick up Western Illinois University and other State agencies in that part of the State. The report also indicated that existing analog microwave equipment could be redeployed from previous implementation phases and used as required to reach locations not on the primary digital route.

2.6 CURRENT RADIO NETWORK REQUIREMENTS

The following agencies have radio systems:

- Illinois State Police
- Secretary of State Police
- Department of Corrections
- Department of Mental Health
- Department of Nuclear Safety

The currently installed analog radio networks have been in service for approximately 10-15 years. The networks share a variety of channels assigned by the F.C.C., and the agencies use these channels for different applications. The radio networks have been engineered separately on an ad-hoc basis to support needs and requirements that surfaced in response to population growth in various areas of the State.

The radio networks do not cover the entire State. They are a series of different systems patched together in concentrated sections of the state with multiple dispatch centers set up to serve each agency's radio transmission requirements. A summary of radio and microwave systems is provided in Figure 2-11.

Illinois Radio/Microwave Networks

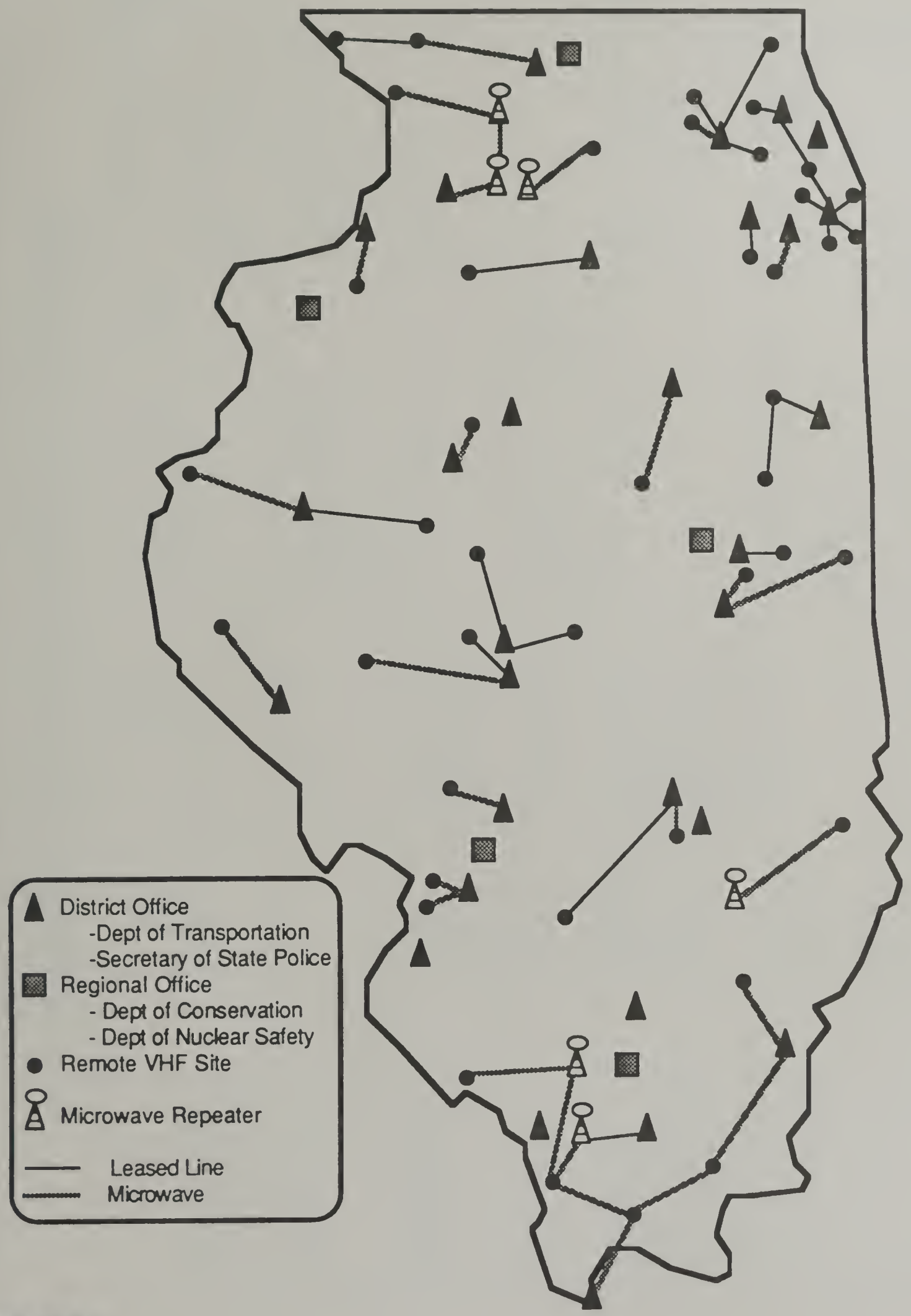

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Figure 2-10

ILLINOIS RADIO/MICROWAVE SYSTEMS

RADIO SYSTEM Agency	Primary System Equipment	Remote Site Equipment & Location	Number of Channels Equipped	Number of Channels Used	% Channel Capacity Used	Interconnectivity with Other Agencies		
						Agency	Type System	Number of Channels
CMS/CSD/Radio Section John Meyers 217/782-3600 Gary Cochran 217/782-3600	Motorola 200 (Illinois State Police)	Short hop relay	200 channels	6-7		Dept of Nuclear Safety Dept of Conservation	Racon 12 P/P Springfield High Band Sys	
Illinois State Police Darrell Bartz 217/782-7345	Motorola	(78) Transmit & Receive Locations (See Map)	600 Sys Max. 480 Licensed for use 40 Channels Low & High Band Licensed	23 Channels (6) 960 HRz (17) 2 GHRz		CMS Corrections Mental Health	Leased Lines to Remote Sites UHF	
Secty. of State/Police Director Watkins 217/785-1691	150 MHz Springfield 150 MHz Chicago Motorola/GE and other types	Base Station (1) Repeaters (Springfield) Base Station (3) Repeaters (Chicago) 1988 - E. St. Louis	8 Channels	5 State-wide 3 local	100%	Conservation ICC	?	?
Dept. of Corrections Bill Lehman 217/522-2666	Motorola/GE Lowband and UHF	(41) Base Station locations all hub into Springfield	(8) Channels Low Band (8) Channels UHF	2-8 2-8	Low use on Low Band 90% use on UHF	None		
Dept. of Transporation Ray Fillipiak 217/782-7974 9 Districts Statewide Dispatch Service-Springfield Hub Expressway Monitoring-Chicago Functions on Separate System Uses Midland Equipment	Motorola/GE Statewide System each District has Base Station All District Hub back to Springfield for Dispatch	(9) District Radio Centers Tower at Merrifield (6) Radios in Schaumburg (2) Spares Monitor Expressway New Dist. Ofc. in Peoria late '87 Helicopter Emergency Unit	FM 47 MHz	All available Channels	Close to 100%	EPA Nuclear Safety	Non-DOT use 12 Vehicles Multple Channel Pick-up	Emergency Use Only as Needed
Dept. Mental Health Jerry Burton 271/782-9546	450 MHz UHF Shared System w/Corrections some Links Motorola/GE Equipment with various	20-25 Local Facilities State-wide	2 Channels 453/875 458/875 950 Security 305 MHz Some Areas	2 Channels	80%	Corrections Police etc.	Shared Channels as needed	

Figure 2-11

2.7 CURRENT VIDEO REQUIREMENTS

Our interviews with agencies and universities indicated no current requirement for statewide video distribution. The universities are independently exploring a number of approaches for incorporating point to point two-way video in the engineering, medical and continuing education programs.

2.8 FUTURE REQUIREMENTS

Summaries of the future agency requirements for voice, data and other major facilities are provided in the following sections.

2.8.1 Future Transmission Facility Requirements

A widespread requirement for increased transmission capability was evident in our interviews. CMS indicated that future growth of intrastate voice traffic is projected at about 5% annually. Most agencies indicated a data network growth of approximately 30% annually. Lottery expects a growth of over 40% annually. The traffic requirements for all agencies are summarized in Appendix F.

The CMS/CSD T1 Network unit regularly review requirements for T1 links to major Illinois cities that have high concentrations of voice and data communications traffic. The CSD T1 unit has identified candidate cities for future T1 channel connectivity to Springfield or Chicago. Those cities identified by CSD for T1 channels are listed below:

- Champaign
- Danville
- Schaumburg
- Rockford
- Joliet
- Collinsville

The concentration of traffic onto wideband facilities increases the risk of communication. A failure on one of these links can cause tens of voice conversations and hundreds of data connections to fail. Diverse routing of transmission facilities would greatly decrease the risk of using wideband transmission facilities. CMS currently provides backup for these transmission facilities by using US Sprint's network or an alternate route provided by Williams Telecommunications.

2.8.2 Future Data Requirements

The needs assessment process identified several significant future data networking requirements. The largest and most imminent change will be in the Illinois State Lottery system. The current growth in statewide lottery terminals will require a larger and faster computer with sophisticated back-up and recovery capabilities. Lottery is delaying the preparation of a major RFP for future Lottery data processing and communications support until the Strategic Communications Network Planning document is presented to the State.

Additional major changes are as follows:

- CMS and Illinois State Police are phasing out all IBM BSC equipment and replacing it with IBM SNA equipment.

- CMS plans to link the HRS application directly with CMS computers via front-end processors at each agency.

- The Illinois State Police have expressed a future requirement for host-to-host connectivity with the Secretary of State's Honeywell computer to allow sharing of database information residing in each computer. There is also a need for the Police computer to be linked to the Public Aid Sperry computer system to allow interconnectivity between the various data bases.

- The Department of Mental Health identified a future requirement to support 400 PCs at various Mental Health Hospitals located across the State. This increased need for PC support is typical at most of the other agencies. There will eventually be a need to interconnect these PCs with LANS, and ultimately to central computer applications programs via LAN gateways.

- Public Aid indicated a unique future requirement for an image storage and retrieval file system at its central system location that would provide remote access from 63 field office locations.

- Many agencies, especially CMS, identified a tremendous growth in the connectivity requirements of distributed systems such as mainframes, minicomputers, and personal computers. This system requirement is growing both in the number of devices to be supported and the amount of bandwidth required for applications such as remote process-to-process applications, file transfers, remote applications integration, and database distribution. Users

will require high-bandwidth transmission facilities to support their low response time requirements.

2.8.3 Future Video Requirements

The State has identified 672 off-campus programs that are candidates for future inter-city video transmission. The State estimated that an average of 3.65 courses were offered per off-campus program. Assuming the most common value for semester credit hours, 3 semester credit hours per course, we calculate a total of 45 instructional hours per course.

Based on these numbers it is possible to estimate the number of instructional hours taking place off-campus. The number of programs offered off-campus (672) multiplied by the average number of courses per program (3.65) multiplied by the number of instructional hours (45) yields an estimate of the number of off-campus instructional hours per year. Performing the multiplication we find a total 2,453 courses yielding a total of 110,376 instructional hours offered off-campus.

At the present time it is impossible to estimate the amount of this off-campus programming that would require inter-city transmission facilities. From Tables 2-1 and 2-2, we can identify a significant amount of intra-city video requirements, but the exact amount of the inter-city video requirements is still unclear.

The following paragraphs explain Tables 2-1 and 2-2. For Table 2-1, there are the following notes:

- Column headings represent those eight community college districts (off-campus sites) which are recipients of 4% or more of the 672 approved off-campus programs.

- The headings are those institutions which offer programs in the eight community college districts 'best' served by off-campus programs.

- The entries are the number of off-campus programs offered in the community college district by the senior institutions indicated.

In Table 2-2, the column headings represent those nine senior institutions which each provide 4% or more of all approved off-campus programs. Row headings are the community college district in which the nine senior institutions offer programs.

Video Programming Receiving

Sponsoring Institution	Dupage (502)	Triton (504)	City College of Chicago (508)	Wm Rainey Harper (512)	Moraine Valley (524)	Joliet (527)	Lake County (532)	Oakton (535)	Total
Aurora University	3			1					4
Chicago College of Osteopathic Medicine	1								1
College of St. Francis	1	2	7	1	2		1	2	16
Illinois Institute of Technology	3	2	2	2	2			2	13
Lewis University	2	1	1	1	1				6
Northern Illinois University	18	15	29	17	13	14	14		120
Southern Illinois University-Edwardsville	1								1
University of Illinois at Urbana/Champaign	3	2	5	6	4				20
Western Illinois University	1								1
University of Illinois at Chicago	2	2		2	2			2	10
National College of Education	4		2	2	1		3		12
Keller Graduate School of Management	1			1					2
DePaul University		15						15	30
Northeastern Illinois University		2							2
Southern Illinois University at Carbondale			2				2		4
University of Chicago			1						1
Taylor Buisness Institute			1						1
Elmhurst College				17	16			16	49
North Central College				1					1
Roosevelt University				27			7	5	39
Ray College of Design				5					5
Illinois State Universtiy						9			9
Lincoln College						7			7
Columbia College							3		3
TOTAL	40	41	50	83	41	30	30	42	357

Table 2-1

Video Programming Originating

	College of St. Francis	DePaul University	Eastern Illinois University	Elmhurst College	Illinois State University	Northern Illinois University	Roosevelt University	Uof I At U/C	Western Illinois University	Total
DuPage	1					18		3	1	23
Triton	2	15				15		2		34
Parkland	2		13							15
Sauk Valley	1					13			1	15
City College of Chicago	7					29		5		41
Elgin	1					13				14
Thronton	2				7	1				10
Rock Valley	2					19		4		25
Wm. Rainey Harper	1			17		17	27	6		68
Illinois Valley	1				8	14				23
Illinois Central	2				8			4	3	17
Praire State	1								2	3
Bellville	1		1					1		3
Moraine Valley	2			16		13		4		35
Lincoln Land	1				1			2	1	5
McHenry	1					14				15
Shawnee	1									1
Lake County	1					14	7			22
Oakton	2	15		16			5			38
Richland	2		8		7			4		21
Kaskaskia			2							2
Danville			7		8			2		17
Illinois Eastern			4							4
Jacksonville*					1				4	5
Kankakee					5					5
Joliet Junior					9	14				23
Black Hawk						8		2	11	21
Waubonsee						2		2		4
Highland						12		1		13
Carl Sandburg									2	2
Lake Land								1		1
Rend Lake								1		1
State								2		2
Spoon River									1	1
John Wood									5	5
TOTAL	34	30	35	49	54	216	39	46	31	534
% Of All Off-Campus	5.1%	4.5%	5.2%	7.3%	8.0%	32.1%	5.8%	6.9%	4.6%	79.5%

Table 2-2

2.9 SUMMARY OF SERVICES TO BE PROVIDED

Users in the various communities expressed needs for a variety of telecommunications services. There were a number of services, however, that were almost universally desired. We recommend the State support the services listed below:

- Private line circuits — The State should support private line circuits including tie-lines, leased point-to-point lines and multipoint lines. High-speed digital facilities should be made available wherever possible.

- Unified telephone network — The State wishes to integrate the various voice systems into a single voice network with a dialing plan consistent with that of the public switched telephone network. All routing decisions would be made by switching equipment. The user would only dial the destination number and would not be required to specify actual routing through a sequence of codes.

- Switched data service — The State should support data switching for IBM Systems Network Architecture (SNA) and non-SNA computer systems. Whenever possible, the State should facilitate connectivity between different vendors computer systems.

- Radio service — The State should provide backbone trunking for radio systems.

- Video transmission service — Although short term requirements are unclear, several users identified long-term requirements for inter-city video transmission. The State should ensure that any system procured has the flexibility to support video applications at a later date.

These services summarize the State's requirements for intercity transmission facilities and network capabilities. The State's current cost for supporting these services is shown in Figure 2-12.

Existing Telecommunications Service Costs
(cost in millions)

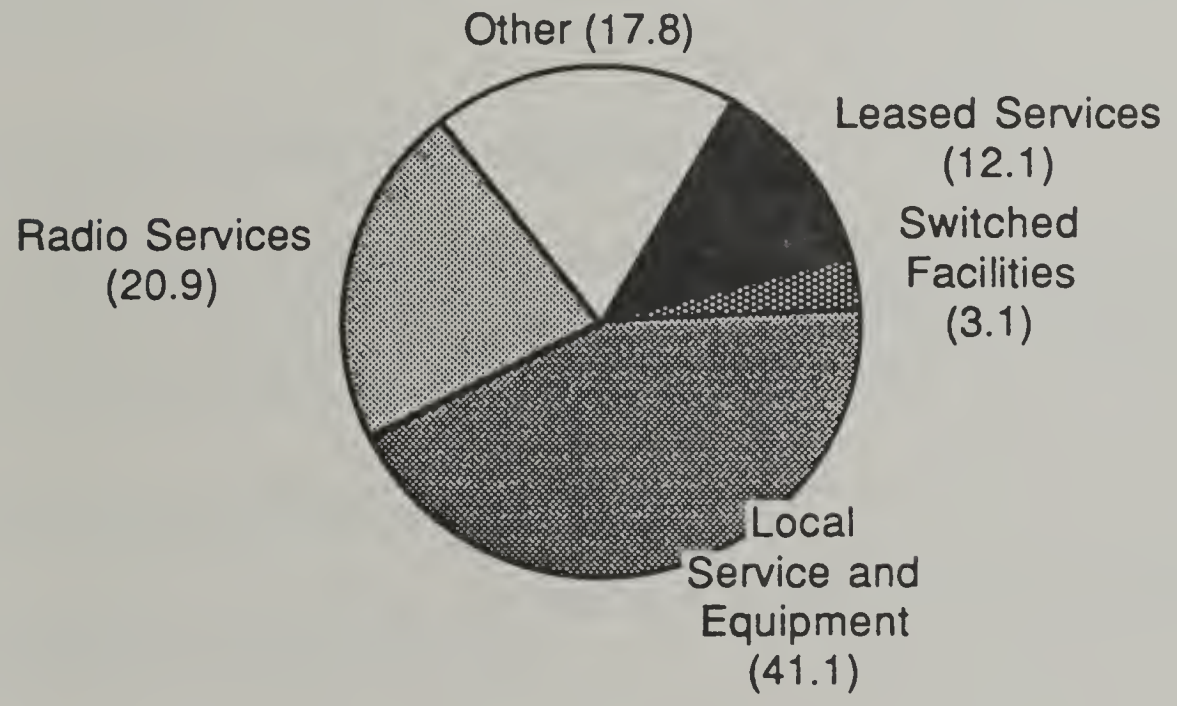


Figure 2-12

3.0 ARCHITECTURES ANALYSIS

As can be seen from the Needs Assessment, the State manages a complex network of digital and analog transmission facilities to provide voice, data, video, and radio service to users throughout the State. The analysis of alternative approaches to providing these transmission facilities and services is the topic of this chapter. This chapter comprises the following sections:

- Analysis of the Network Architecture
- Digital backbone network
- Video network alternatives analysis
- Voice network alternatives analysis
- Data network alternatives analysis
- Potential additional cost savings

The first section briefly introduces each of the major components of the network architecture and the technical evaluation criteria. In the following four sections, we briefly describe the alternatives, delineate the advantages and disadvantages of each alternative, and identify the associated cost tradeoffs. The last section describes how the recommended network architecture will position the State to take advantage of additional cost savings.

3.1 Analysis of the Network Architecture

The network architecture analysis is separated into analyses of voice, data, video, and transmission facility services. Each of these different components of the network architecture and the technical evaluation criteria used to measure the different alternatives are described in the following two sections.

3.1.1 Components of the Network Architecture

The components of the network architecture and their relationships are illustrated in Figure 3-1 and listed below:

- Transmission Facilities
- Facility Allocation Control
- Circuit Switching
- Packet Switching
- Systems Integration

The transmission facility is the supporting base for all network services. The transmission facility is the physical media used to carry information and it can be an actual physical facility, such as fiber-optic cable, microwave equipment, twisted-pair, or

Components of the Illinois State Architecture

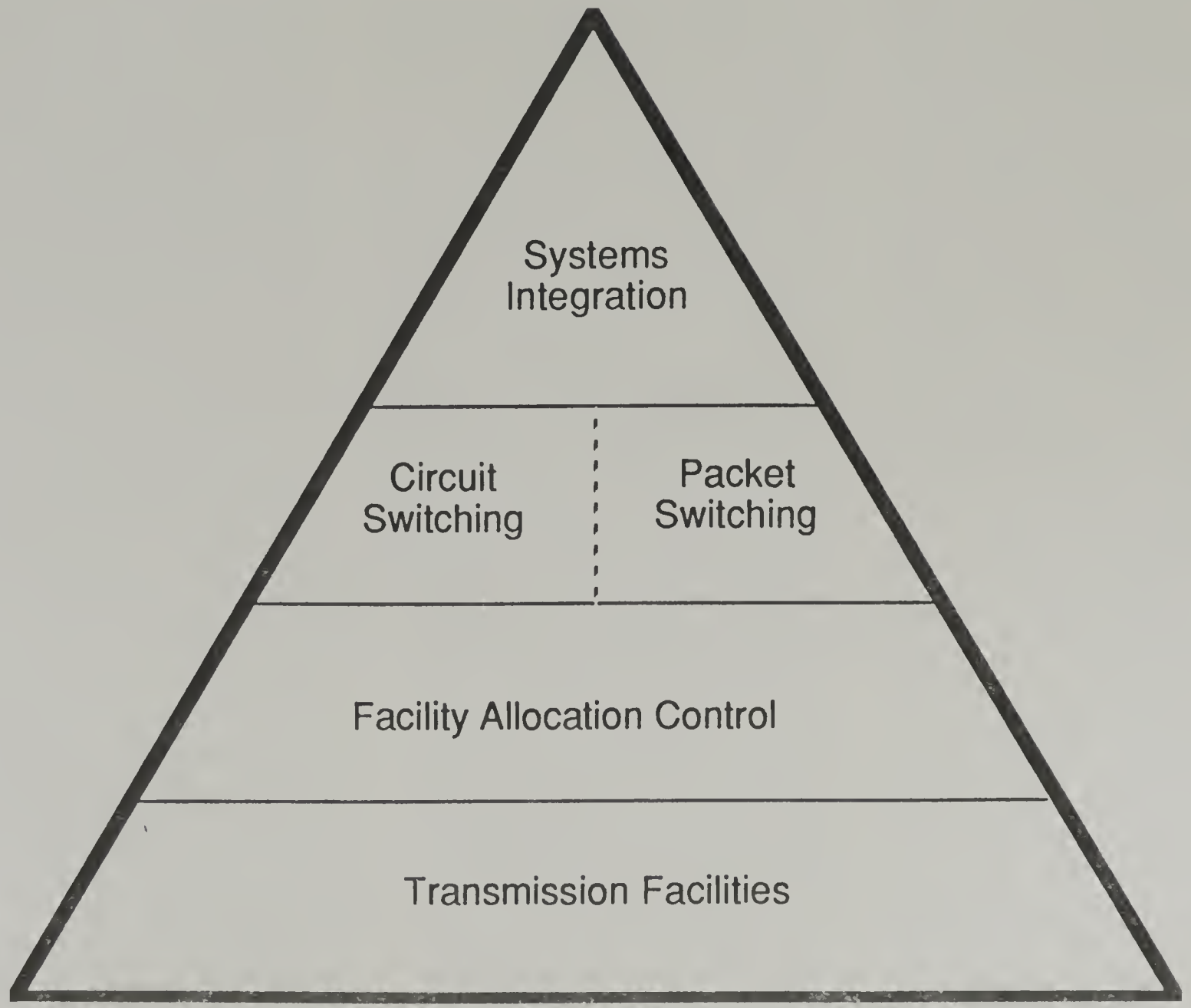


Figure 3-1

coaxial cable, or if can be leased services, such as multipoint lines, tie-lines, T1 circuits, or T3 circuits. The capacity of these transmission facilities are listed in Figure 3-2. These transmission facilities do not provide any switching, multiplexing, or routing capabilities. These functions are all provided by network components higher up the "triangle".

Facility allocation control is multiplexing and diverse route switching capability for transmission facilities. Multiplexers combine multiple low-speed circuits onto a higher speed circuit. For example, a multiplexer is required to multiplex 24 voice tie-lines onto one T1 and 28 T1s onto one T3. Hundreds of data circuits can typically be multiplexed into a single T1. When using high-bandwidth transmission facilities, there is greater risk in the case of a failure. In this case, the high-bandwidth transmission facilities require route switching capability to switch from failed facilities onto backup facilities that travel a different route. This switching is dynamically controlled, but usually takes several minutes to several hours to complete. For example, the telephone companies use a diverse route switch called a Digital Access and Cross-connect System (DACS) to switch T1 and T3 lines inside their network.

The combination of transmission facilities and facility allocation control is referred to as an integrated backbone network, and is shown in Figure 3-3. The facility allocation control controls the use of high-bandwidth backbone transmission facilities between network services, such as voice and data switching. The facility allocation control is usually the system used to manage transmission facilities in case of failures, to isolate problems, and to operate the system on a daily basis. A number of major telecommunications users have built large T1 networks, which is one particular type of integrated backbone network that uses T1 transmission facilities and sophisticated T1 multiplexers for facility allocation control. These users have realized significant savings (between 10% and 40% in many cases) and have gained a significant strategic advantage over their competitors because of the flexibility of the integrated backbone network in supporting future requirements.

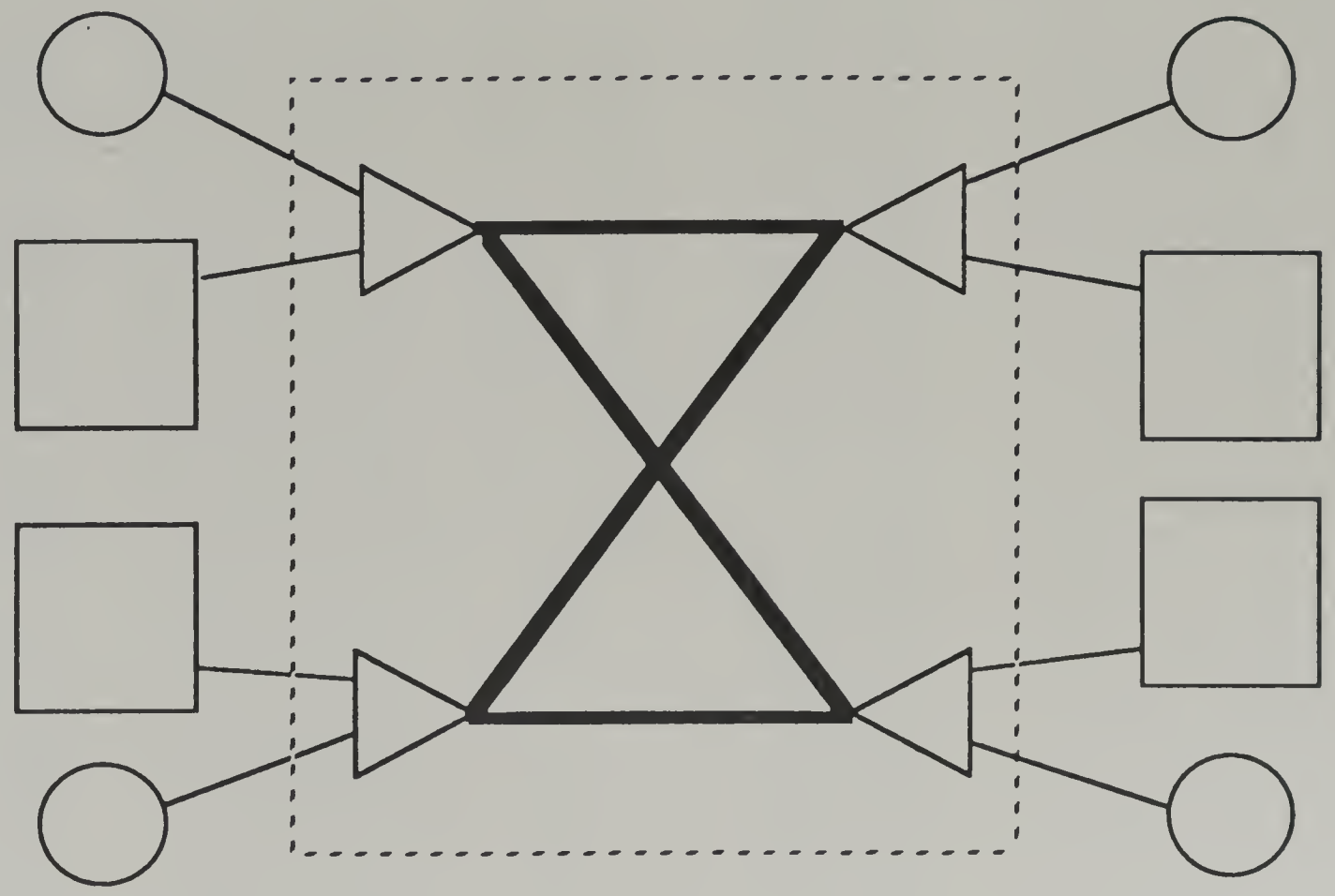
Voice and data networks are the two major types of services that use the integrated backbone network, as shown in Figure 3-3. Voice networks typically use a technique called circuit switching to switch telephone calls between multiple users, and data networks typically use a technique called packet switching to switch data traffic between multiple computers and terminals. In circuit switching the user requests a connection (e.g., by dialing a phone number) over a shared network. The network then sets up a temporary dedicated link between two parties. Once the connection is made, the users can send any data over the line; that is, the connection can be used for voice or data traffic. Upon termination of the call the dedicated link is dismantled and the resources are made available to other users. Circuit switching is best suited for an environment where calls are made infrequently and the holding times are short (e.g., a short telephone call). If the calling party requests a connection and no network resources are available or if the called party is using his phone, the calling party will be

Transmission Facility Capacity Comparison

TRANSMISSION MEDIUM	VOICE CPAPCITY (Based on 64 kbps Voice)	TYPICAL DATA CAPACITY
Twisted Pair (analog)	1	9.6 kbps
T1	24	1.5 Mbps
T3	672	45 Mbps
Microwave	1344	90 Mbps
Satellite Transponder	768	60 Mbps
Coaxial Cable	4092	274 Mbps
Fiber Optics	6048	405 Mbps

Figure 3-2

Digital Backbone Network



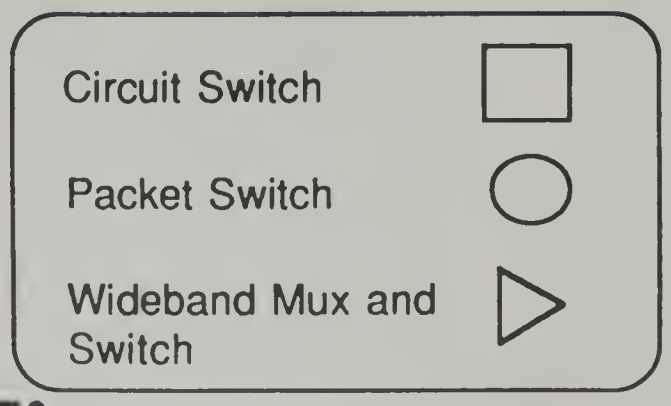


Figure 3-3

blocked, which is usually indicated to the calling party as a busy signal. Circuit switching networks are designed with a certain level of blocking in the expected busiest hour. The State's existing telephone network is based on circuit switching techniques.

In packet switching, the computer or terminal breaks all messages into small pieces called packets, attaches addressing information, and transmits the packets to its local packet switch. Packets are held in the packet switching node's buffer just long enough for previous packets to be transmitted and error control/recovery processes to be completed. Each node forwards the packet to the next node on its route from source-node to destination-node. Different packets may travel different routes through the network. If a packet switching node is busy, the packet may have to wait a longer time before being transmitted to the next node. This delay is usually less than one second, but can be several seconds in heavy traffic. The user sees this added delay in increased response time. Packet switching networks are designed for a certain delay in the expected busiest hour. CMS's existing data network is based on packet switching.

Systems integration is a management function and therefore is discussed in the Management Analysis, Section 4.2. Systems integration is necessary to ensure that all of the different network components — transmission facilities, facility allocation control, circuit switching, and packet switching — work as a coherent whole.

3.1.2 Technical Evaluation Criteria

We used the following technical evaluation criteria to evaluate the alternatives described in Section 3-2 through 3-5:

- Ease of network management — The State must consider how to manage billing, failure isolation, intermittent problems, traffic detail collection, performance monitoring, installation of new equipment and services, and maintenance. The ease that various alternatives support network management dramatically decreases the load on State personnel and increases the network's perceived performance to State users.

- Network performance impacts — The State must consider how the various alternatives affect network performance including geographic availability transmission speed, throughput, response time, error rate, downtime, ease of installation, connectivity, interoperability, and types of equipment supported. Any recommended alternative should meet or exceed existing voice or data network performance capabilities.

- Ability to support future requirements — With the expected growth in voice and data traffic and the possible future growth of intercity video, any alternative must be evaluated on its ability to support these new bandwidth requirements. In addition, new voice and data services are expected to grow, and thus fundamentally change the structure of the telecommunications network supporting those services. For example, many users are expecting personal computers to grow dramatically. These systems are distributed in nature and require connectivity to a greater number of systems (both other personal computers and hosts) than typical terminal-to-host connectivity, which is the dominate data network requirement in the State today.

- System reliability — Many State systems, such as State Police and Public Aid, require high levels of reliability because of the severe detrimental effects of failures. Therefore, alternatives that support diverse connection capability, inherent backup schemes, better uptime for primary systems, and better overall performance increase the system reliability.

- Cost — The State must consider the lifecycle costs of each of the various alternatives.

These five evaluation criteria are used to evaluate the various alternatives described in the following sections.

3.2 DIGITAL BACKBONE NETWORK

The digital backbone network consists of two components, transmission facilities and facility allocation control, as shown in Figure 3-3. These two combine to form a utility that any network service, including voice, data, and video, can use. The only difference on how these various services would use the backbone network is the amount of bandwidth different services would require.

Typically, data services require approximately 10,000 bit per second (bps) for a connection between terminals and computers. Computer to computer connections generally require 64,000 bps, five to six times the bandwidth required between terminals and hosts. Voice connections normally require 64,000 bps. Video connections require anywhere from 1,500,000 bps (or 1.5 Million bps) to 90,000,000 mbps, an increase in bandwidth of greater than two orders of magnitude. The bandwidth requirements for these different network services are illustrated in Figure 3-4.

Transmission Channel Bandwidths

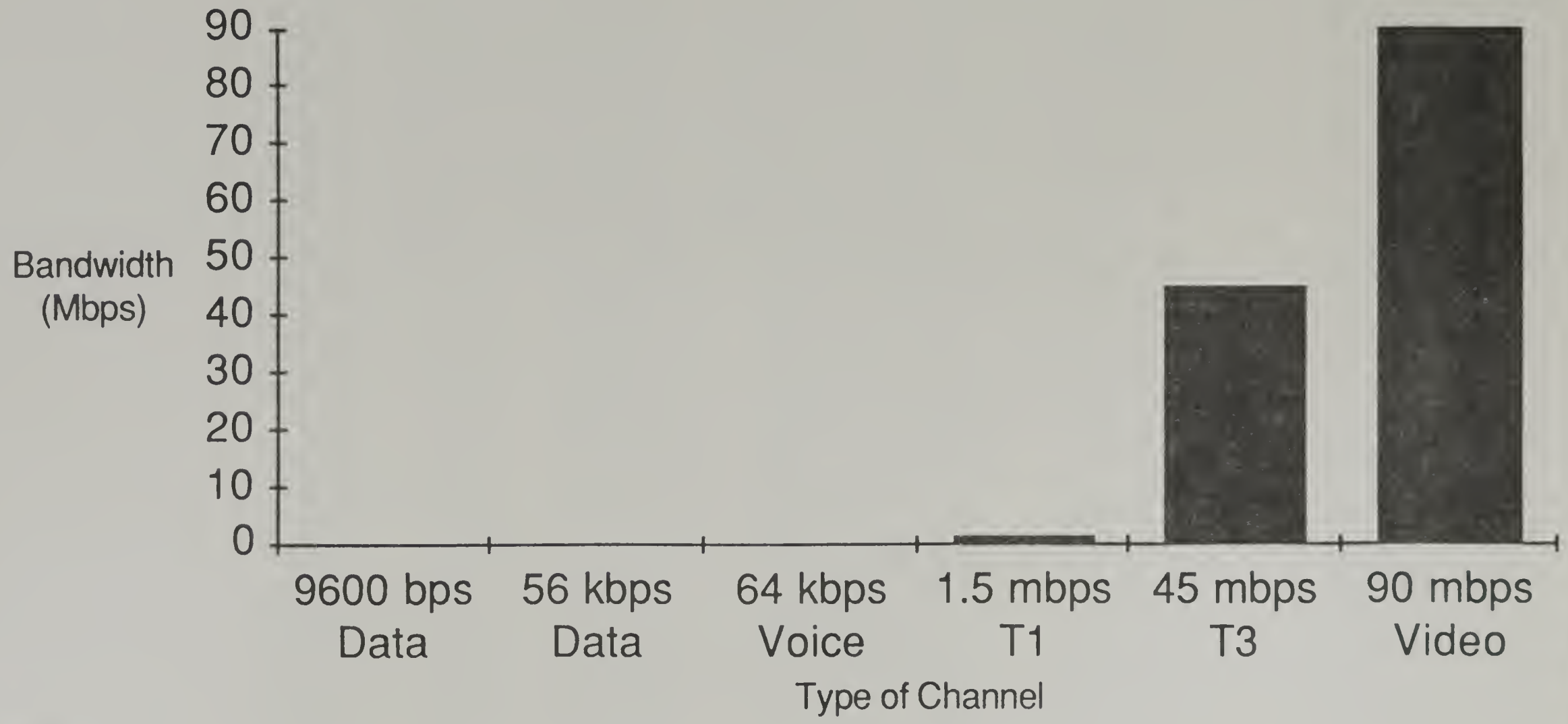


Figure 3-4

Data transmission is inherently digital, and therefore for most new networks, digital transmission facilities are the preferred transmission facilities. Voice and video, however, are inherently analog. Nevertheless, the preferred facilities for both voice and video are digital because of digital transmission facilities' superior performance, greater capacity, and lower cost. In addition, most modern switches for data, voice, and video are digital because of the superiority of digital switching architectures. Therefore, most backbone networks are referred to as digital backbone networks.

3.2.1 Alternatives

The State has two primary alternatives for providing support for transmission facilities and facility allocation control: 1) the current transmission facility network consisting of a mix of analog and digital facilities, hereafter referred to as the baseline facilities network, or 2) an integrated digital backbone network connecting major locations with high-speed digital transmission facilities.

The State's current transmission facilities' network is composed of digital and analog transmission technologies. Analog multipoint lines are used to serve most of the State's data network users including CMS's and Lottery's data network. Analog trunks are used between voice switches with sufficient voice traffic between systems. Wherever economically feasible, CMS has provided a digital backbone network service for the State's telecommunications users. For example, CMS has implemented T1 service between several locations in the State, combining multiple low-speed analog lines onto high-speed digital lines.

NSI analyzed the traffic requirements for two and five years. Five years is the latest year of the strategic plan and two years is the earliest the State could implement a statewide integrated backbone network. State personnel estimated traffic growth at 5% annually for voice and 30% annually for data. Detailed traffic loads in the two and five year timeframes are listed in Appendix F.

An overlay of the State's voice tie-trunk network, CMS's data network, and Lottery's data network is shown in Figure 3-5. As can be seen there is a number of transmission facilities using the same routes.

Using the traffic data described in Appendix F, NSI designed a digital backbone network to support voice and data traffic, as illustrated in Figure 3-6. Using proprietary network modeling tools, we identified a three level node hierarchy as described below:

Combined Networks Overlay

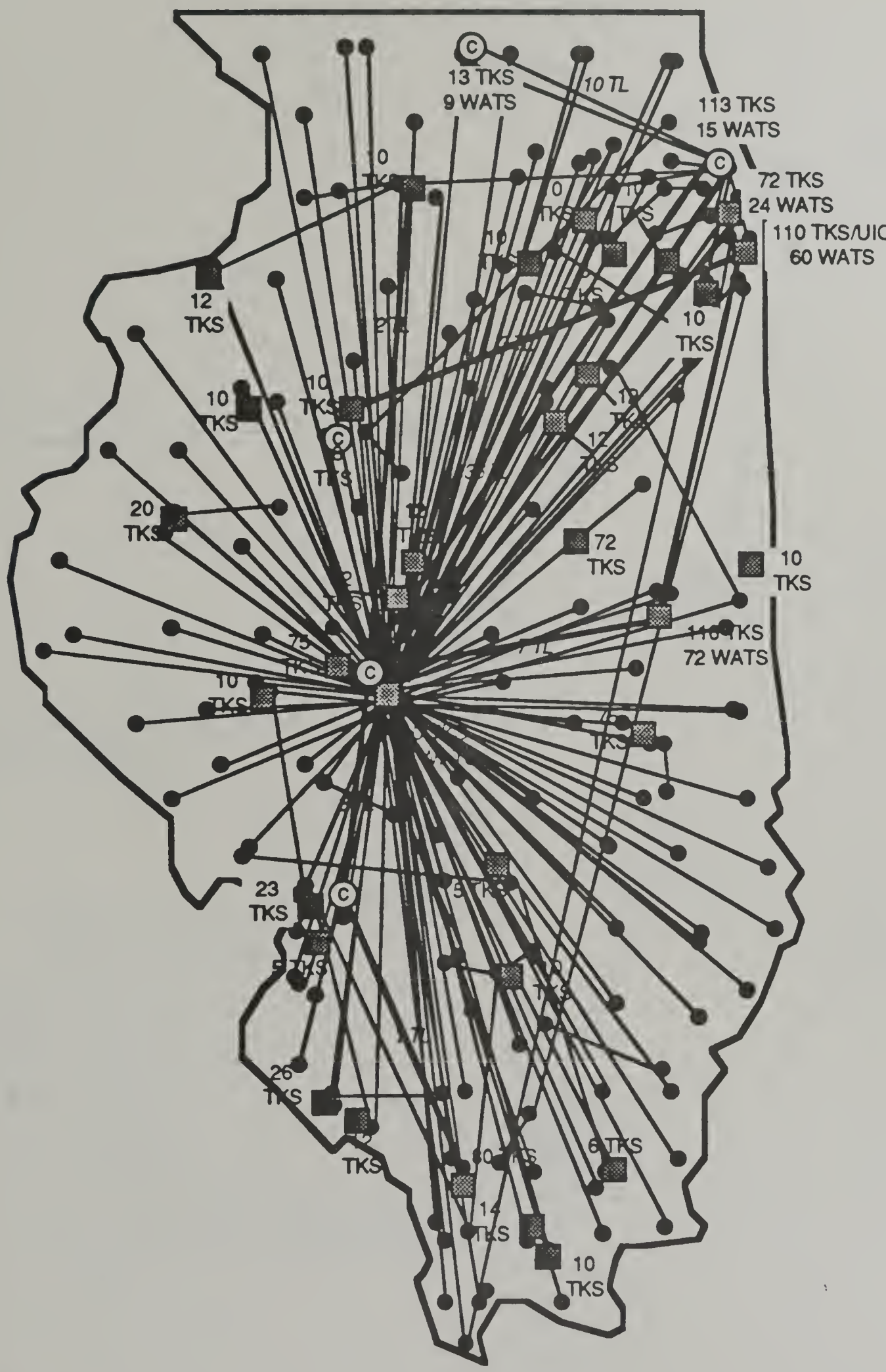


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Figure 3-5

Integrated Networks

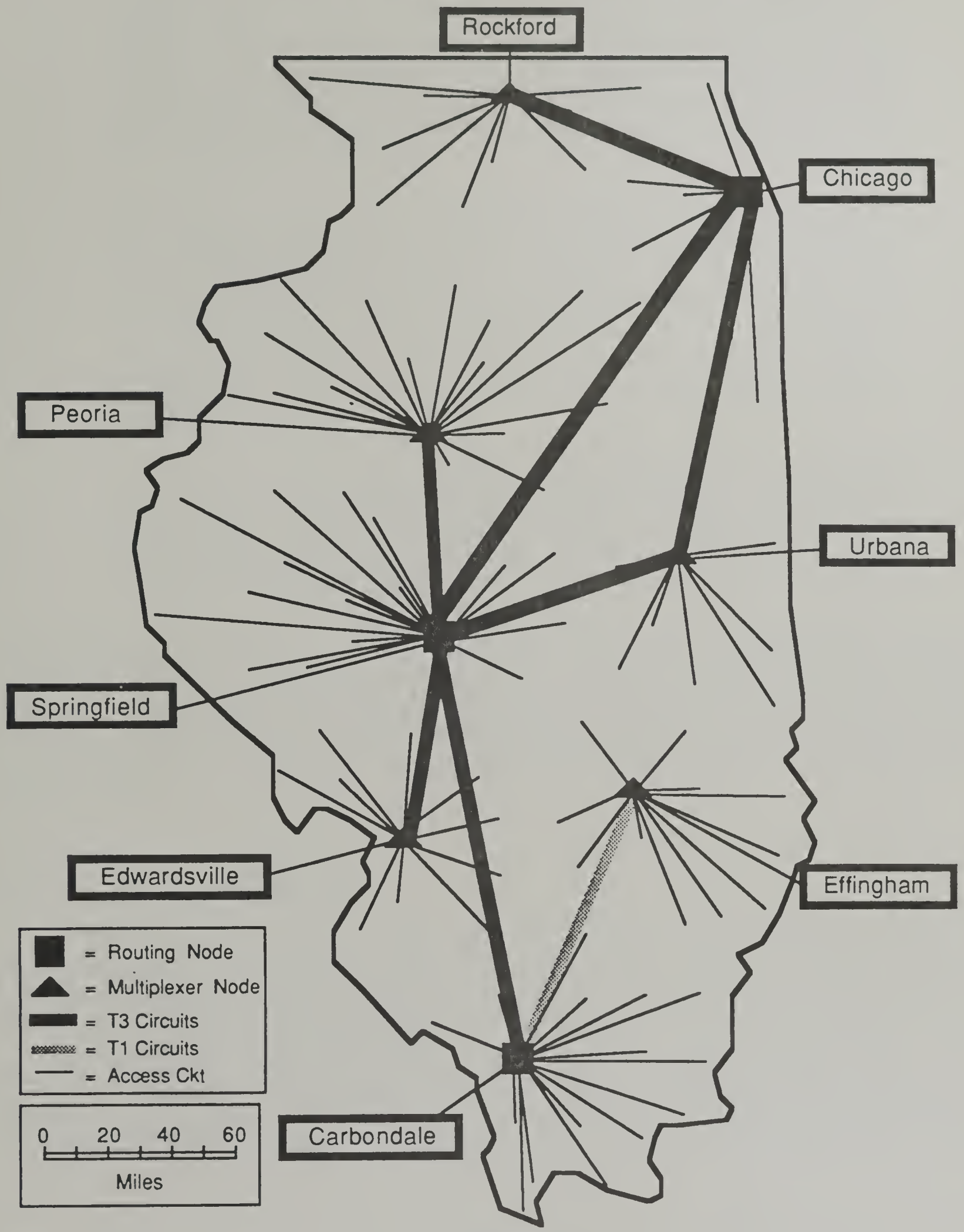


Figure 3-6

- Routing nodes — Four routing nodes were identified, Chicago, Springfield, Champaign/Urbana, and Carbondale. At these locations the State would provide tandem switching capability to allow users to switch through this location to other locations. In addition, the State may provide packet switching capability at these locations for data services. These four nodes are the highest levels of the network and would support traffic from the multiplexer nodes that were connected to it. All traffic from the multiplexer nodes would be routed to a routing node.

- Multiplexer nodes — The multiplexer nodes are at the boundary of the integrated backbone network. At these locations, the State would install sophisticated T1 multiplexers that would do multiplexing and protocol conversion to the format and speed used on the backbone. One possible candidate for the smaller multiplexer nodes is the State's existing Timeplex Link/1 multiplexers. End nodes would connect to the multiplexer nodes using access circuits.

- End nodes — End nodes are voice and data equipment being used by end users. Examples of this equipment include Private Branch Exchanges (PBXs), Centrex systems, packet switches, communications processors, cluster controllers, and Local Area Network (LAN) gateways.

T3 transmission facilities are used to connect most of the routing nodes and the multiplexer nodes. Effingham requires 5 T1s between it and Carbondale. Other locations, such as major University cities, will require connectivity to the backbone with T-carrier circuits. Tie-lines, short-haul leased data circuits, and T1 lines are three possible types of access circuits. The particular type will depend on the traffic load at the end-node.

3.2.2 Technical Evaluation

The integrated backbone digital network is superior to the baseline network in every category. An integrated facility allocation control system provides superior network management both for isolating failures and in monitoring the performance of the entire network. The integrated backbone digital network is superior in every aspect of network performance including delay, capacity, network availability, and transmission quality. Because the integrated digital backbone network has spare capacity to most routing and multiplexer nodes, the network is better able to support future requirements for additional capacity and short implementation timeframes. From

a reliability standpoint, the superior network management performance of the facility allocation control system will ensure superior reliability.

The State has begun the implementation of the integrated digital backbone network, but has been limited by the availability of digital transmission facilities in rural areas of the State. The current carriers in the State of Illinois have an investment in analog transmission technology, especially in the rural parts of the State. The carriers have not had sufficient justification to install digital facilities to these locations because of the risk that digital service might not be used. Bundled procurement approaches, as described in Procurement Strategies, Section 4.3.3.1, can alleviate this constraint.

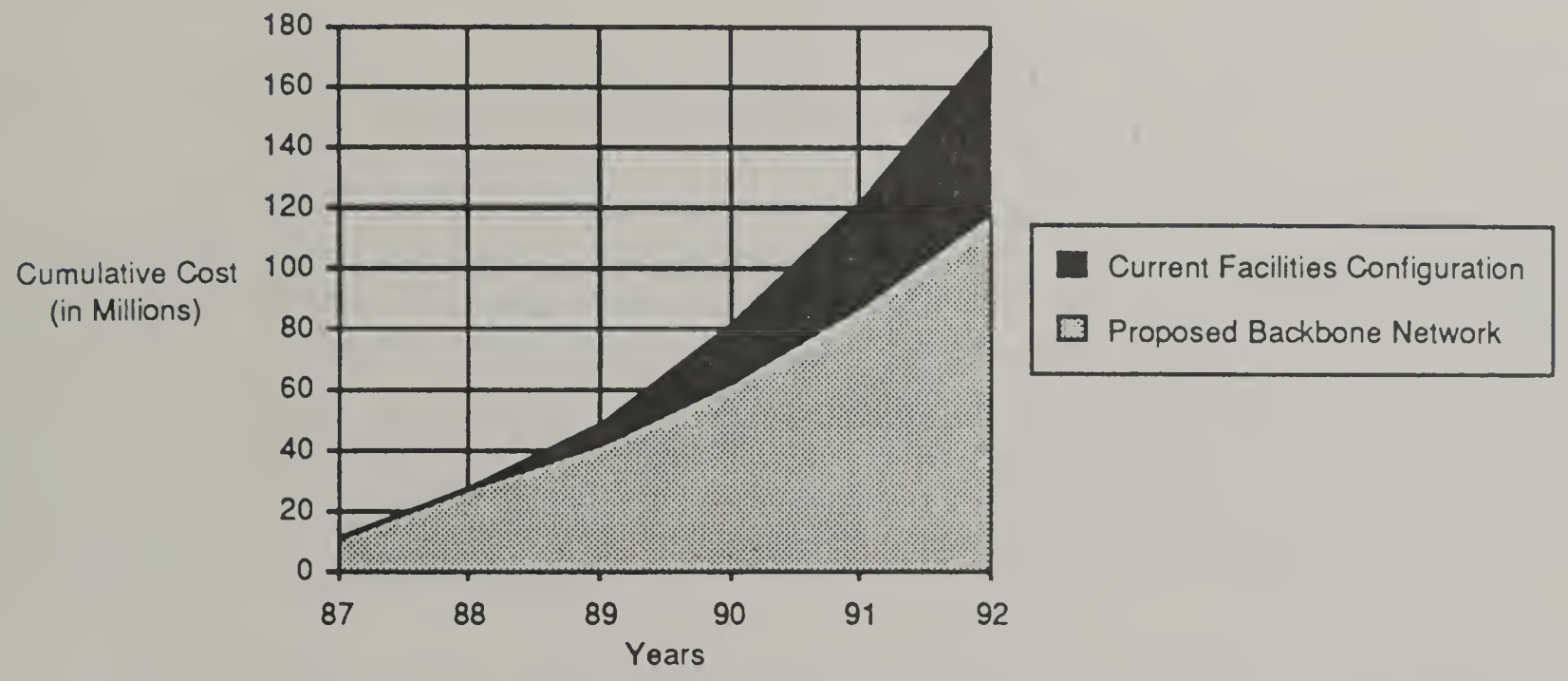
Figure 3-7 illustrates the cumulative costs of the baseline network and the integrated digital backbone network. Both network options are based on the requirements supplied by the State that data traffic is growing 30% annually and voice traffic is growing 5% annually. Any additional circuits to be provided in the baseline network option will be provided in the current manner, that is, new terminals will require additional leased lines. The facilities costs for the baseline network are escalated at 5% annually due to the effects of tariff increases.

In the first year of either option, the State will spend approximately $16,000,000 in voice and data transmission facilities because the State will not begin implementation of the integrated digital backbone network until year two. During the second year the State will start to receive cost savings because of the initial implementation of the integrated digital backbone network. Therefore, during the second year the State will save approximately $6,000,000. These costs savings are attributed to two factors, economies of scale by concentrating traffic and the marginal cost of adding new facilities during the second year. During the third year of the plan, the State will save approximately $11,000,000, or a cumulative cost savings of approximately $36,000,000. During the fifth year of the plan, the State will save approximately $26,000,000. Overall, the State will receive cost savings of approximately $62,000,000 during the five-year timeframe of this plan.

We priced a circuit between Springfield and Peoria as an example. Using the tariff costs for the baseline network and the estimated costs of the integrated digital backbone network, we estimated the cost of a point-to-point leased line between Springfield and Peoria. The monthly cost for providing a circuit in the baseline configuration is listed below:

- Long-haul transmission facility — $208
- Local transmission facility — $80
- Equipment cost (9.6 Kbps modems) — $200

Cumulative Cost of Current and Proposed Facilities Configurations



Network Strategies, Inc.

Figure 3-7

Therefore, the total monthly cost is $488. The monthly cost for providing a circuit in the integrated digital backbone network configuration is listed below:

- Long-haul transmission facility — $15
- Local transmission facility — $80
- Equipment cost (9.6 Kbps modems) — $225

Therefore, the total monthly cost is $320. For this particular example, the integrated backbone digital network provides a cost savings of 34% over the baseline network.

3.2.3 Recommendation

We recommend the State procure an integrated digital backbone network because of its superiority over the baseline network, both in its technical evaluation and because of its lower cost. This backbone network provides better support for all of the voice and data networks it must support. The integrated digital backbone network also positions the State to take advantage of additional cost savings identified in Section 3.6.

3.3 VIDEO NETWORK ALTERNATIVE ANALYSIS

Video networks are in operation within campuses or metropolitan areas (for example, the Illinois Institute of Technology has an extensive Instructional Television System in the greater Chicago area) and video programming is distributed using hand delivery to a variety of locations. However, there is no statewide intercity video network. The programming requirements for distribution of video between campuses and their corresponding requirements for intercity transmission facilities is uncertain at this point. Therefore, we recommend the State begin a pilot test to demonstrate the feasibility of video services within the State and to analyze some or all of the video network options described below.

There are two major issues that define the different video alternatives for the State of Illinois, the quality of the video signal and the network configuration. The highest quality video is typically described as Television Network Quality (TNQ) and meets all relevant standards as defined by major standards organizations. The major television networks (i.e., ABC, NBC, and CBS) use video systems that meet these standards. Lower quality video is usually described as Conference Grade (CG) and is used for corporate videoconferencing systems. The quality degradation is noticeable when comparing TNQ and CG video side-by-side, but is difficult to notice without a side-by-side comparison. Typically CG video has less color definition, blurring between different fields (e.g., at the fringes of any object), and slight blurring of an object in motion. In our experience, the quality of the monitor and the quality of the

associated audio and graphics signals is usually more critical than the quality of the video signal.

TNQ video and CG video have dramatically different transmission requirements. CG video usually requires a T1 transmission facility at 1.5 mbps; TNQ video requires a T3 transmission facility at 45 mbps (28 times the bandwidth of CG video).

The second major issue, network configuration, is dictated by the State's requirement for two-way or one-way video. Most educational video applications are described as broadcast, meaning one-way video with a talkback audio path. Most conferencing applications typically require two-way video, which is typically called point-to-point video. Therefore, as part of the pilot the State needs to identify the video network configuration requirements. For this analysis, we provided cost information on both point-to-point and broadcast video. The TNQ versus CG video technical comparison is the same for both point-to-point and broadcast video.

3.3.1 Alternatives

For providing intercity video network services, the State has the following three options:

- Conference grade video
- Terrestrial television network quality video
- Satellite television network quality video

We separated the terrestrial and satellite TNQ video options because of the different transmission technology. Terrestrial TNQ video is primarily supported by T3 facilities. Satellite TNQ video, however, is primarily supported by analog facilities of a satellite transponder. The video signal quality differences between terrestrial and satellite TNQ video are negligible. Because of the satellite delay and the different network equipment, however, overall system performance and cost are dramatically different.

3.3.2 Technical Evaluation

The evaluation of conference grade video versus terrestrial and satellite television network quality video is summarized below:

- Ease of network management — The CG video is superior to both the terrestrial and satellite TNQ video options because it uses lower bandwidth facilities(i.e., T1). The State can provide equipment with superior network management capabilities at T1 rates. Both of the

TNQ video options have approximately equal network management capabilities.

- Network performance — The CG video is superior to both TNQ video options in bandwidth requirements. The T1 transmission speed can be carried on the integrated digital backbone network at only a marginal cost because the T3 transmission facilities on the backbone are only partially full. Both of the TNQ video options require the State to buy additional T3 transmission facilities at substantial additional cost. Both of the TNQ video options have superior video signals. The terrestrial option has shorter delay and therefore works better than satellite transmission facilities with the added delay. This delay is especially noticeable when asking questions, because the professor is 1/4 of a second ahead of the rest of the class.

- Ability to support future requirements — Because the CG video can be carried in a backbone T3 transmission facility, it is more easily supported than either TNQ video option. The satellite video option can provide inter-state broadcast capability if universities in the State of Illinois decide to transmit programming out-of-state. Because the requirement for inter-state video is uncertain, we rated the CG video option superior to other options.

- Reliability — From a reliability standpoint, the satellite TNQ video option is superior to both of the other options because of the superior uptime of satellite transmission facilities as compared to terrestrial transmission facilities.

The CG video option is superior to both of the TNQ video options based on the criteria above. However, if the State requires video quality better than conference grade, the State should use one of the TNQ video options. The primary factor in deciding between satellite and terrestrial video is cost, because both TNQ video options are about equal in technical performance. The video configuration, shown in Figure 3-8 was developed from information supplied by the State.

As can be seen in Figure 3-9, for point-to-point video applications the CG video costs $100,000, the terrestrial TNQ video costs 1,100,000, and the satellite TNQ video costs $3,500,000. When comparing the total cost with and without the integrated digital backbone network, the cost savings range from 1% to 50% between all three point-to-point video options.

Video Configuration

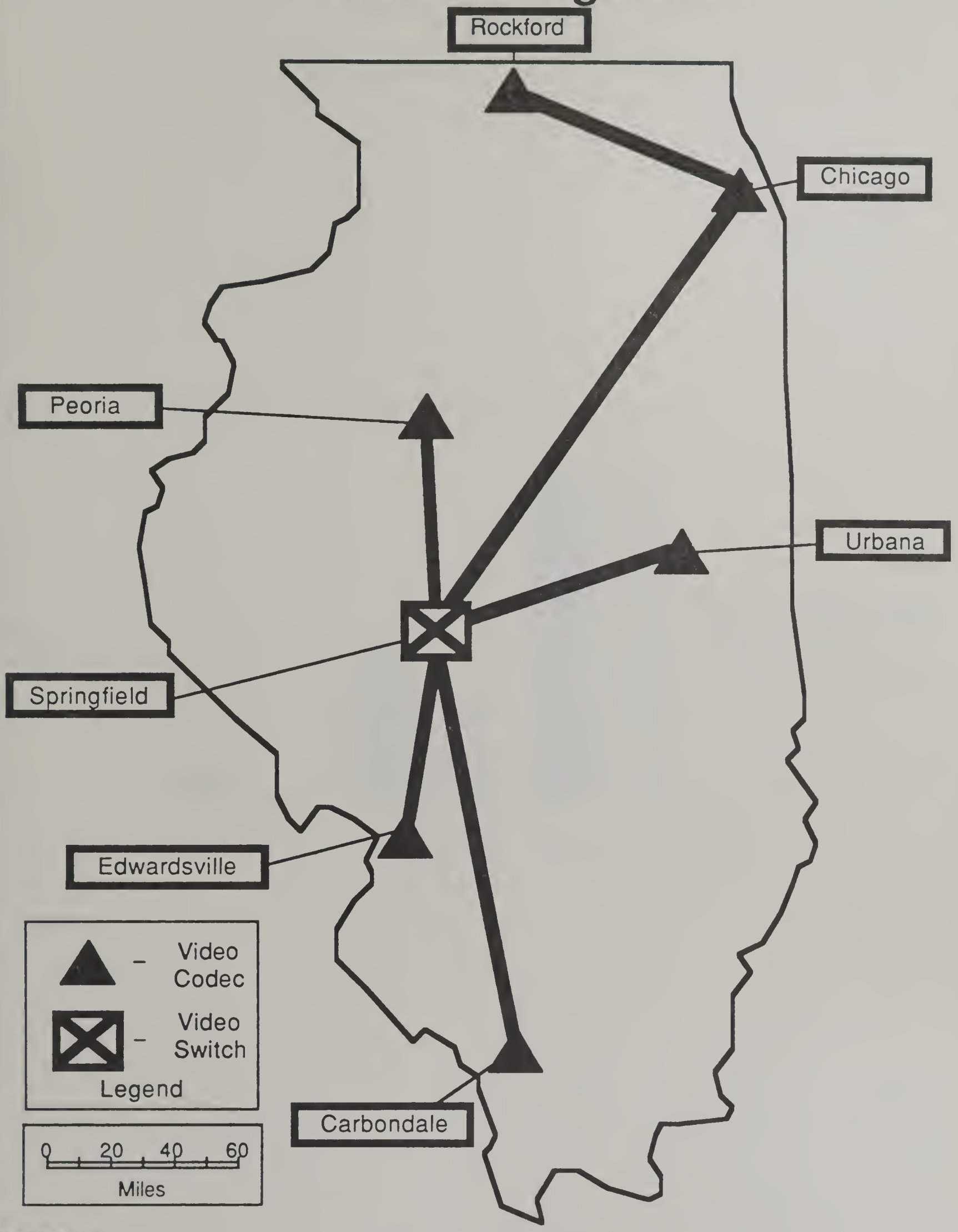


Figure 3-8

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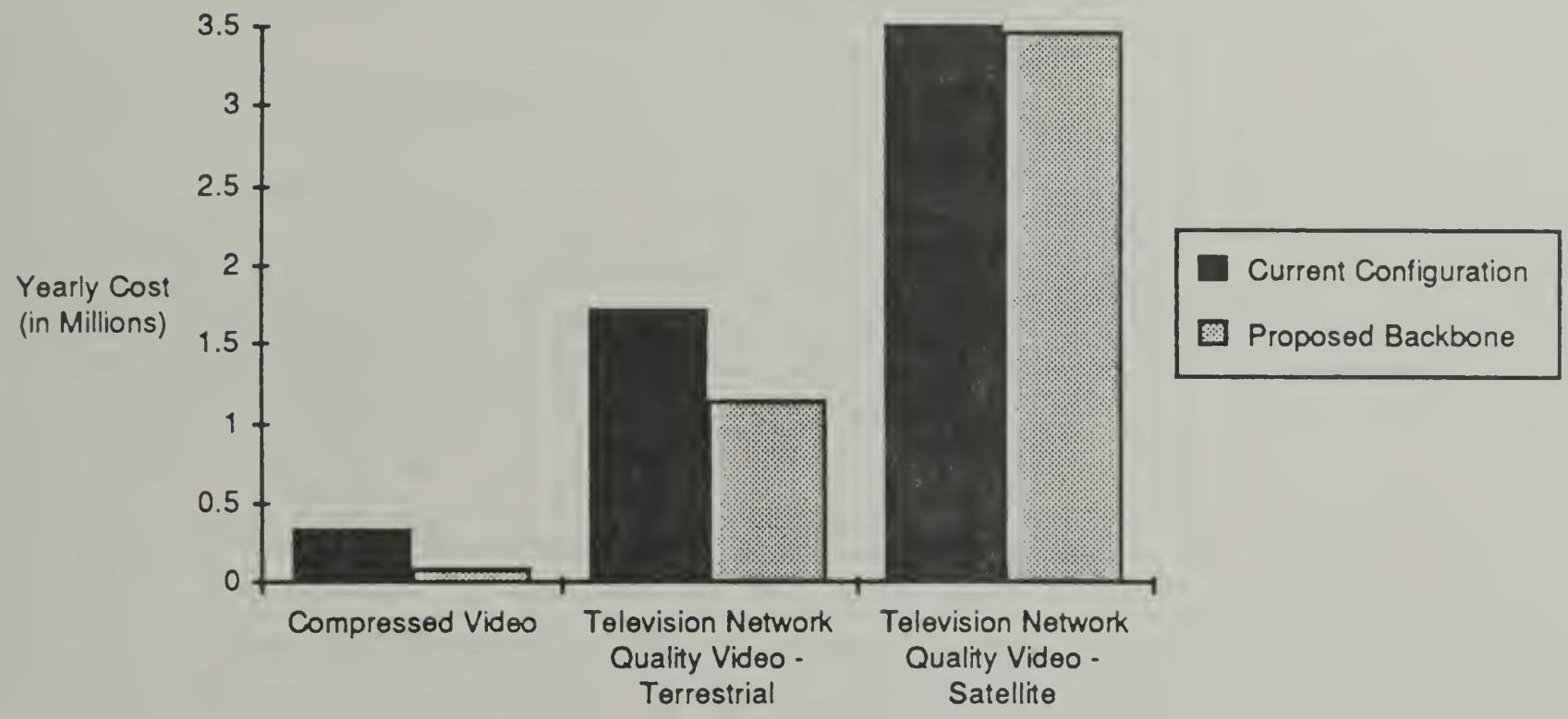
Yearly Cost of Adding Point-to-Point Video



Network Strategies, Inc.

Figure 3-9

As can be seen in Figure 3-10, for broadcast video applications the CG video costs $4,900,000, the terrestrial TNQ video costs $6,000,000, and the satellite TNQ video costs $3,300,000. When comparing the total cost with and without the integrated digital backbone network, the cost savings range from 1% to 5% between all three broadcast video options. For both point-to-point and broadcast video the backbone network strategically positions the State to take advantage of digital technology in the future.

In addition to the cost for transmission facilities and video switching, users must bear the costs of equipping and maintaining a videoconferencing room. The cost for these rooms varies dramatically, but we have provided the following costs estimates for building a new videoconferencing room:

- Video equipment — Varies from $15,000 to $70,000
- Audio equipment — Varies from $3,000 to $20,000
- Graphics equipment — Varies from $15,000 to $70,000
- Room modifications — Varies from no cost to $150,000
- Codec equipment — Varies from $30,000 to $100,000
- Encryption equipment — Varies from $5,000 to $20,000

3.3.3 Recommendation

Given the uncertainty of the State's intercity video requirements, we recommend the State begin a video test pilot to determine the most appropriate technology to meet its video requirements. The CG video is superior to both TNQ video options in almost every category except for the quality of the video signal. If the State finds CG video acceptable, then the CG video option could be implemented at marginal cost.

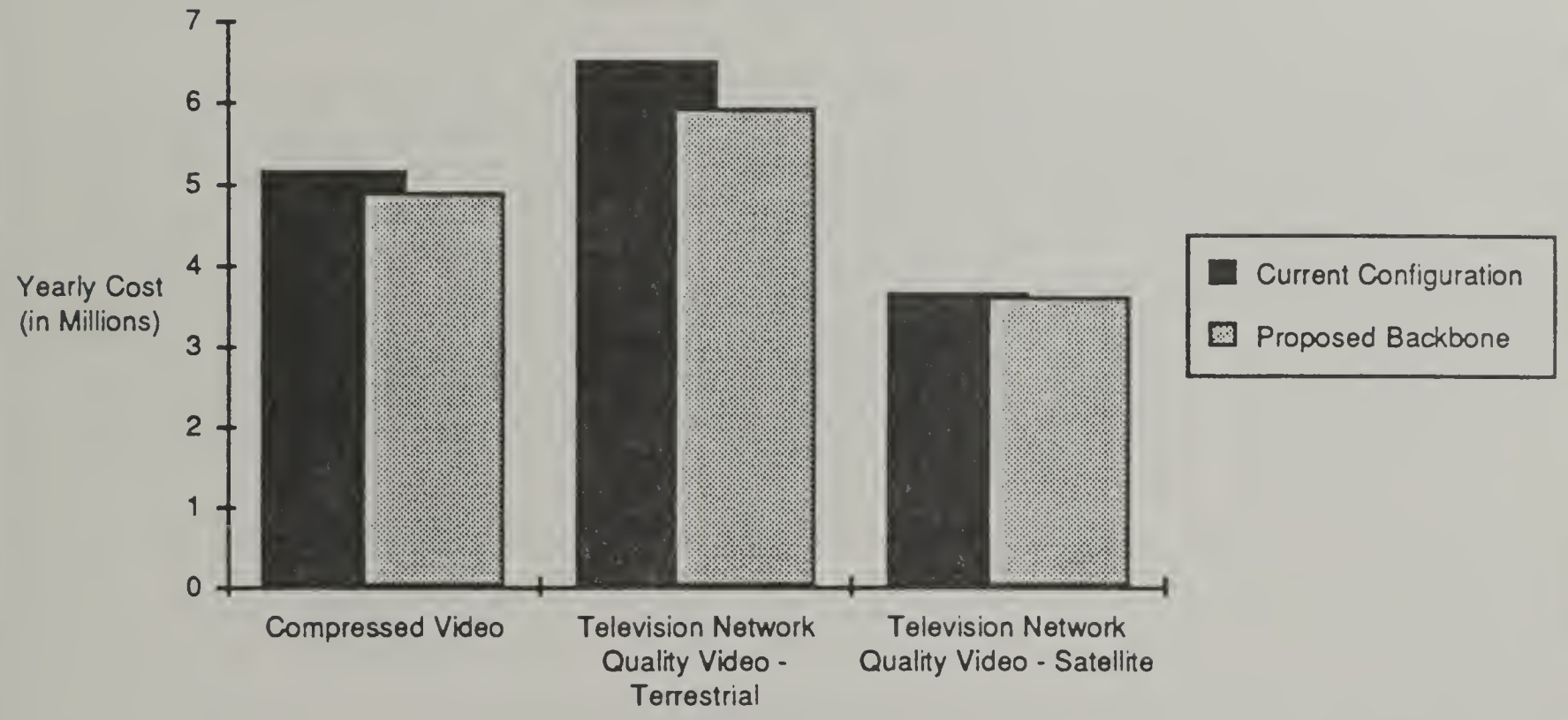
3.4 VOICE NETWORK ALTERNATIVE ANALYSIS

The voice network is an intercity network using tie-lines (tie-line is a specialized term referring to a transmission facility connecting two voice switches) between PBXs and Centrex systems. A PBX is an on-premise voice switch and a Centrex system is a service provided by the local telephone company out of the nearest central office. The State currently has a variety of PBXs and Centrex systems.

3.4.1 Alternatives

The State has two major choices for a statewide voice network, 1) a Tandem Tie Trunk Network (TTTN), which is the baseline voice network and 2) a transparent uniform numbering plan voice network, based on an architecture described below.

Yearly Cost of Adding Broadcast Video



Network Strategies, Inc.

Figure 3-10

The technology for TTTN was developed in the early 1970s and is two generations old. From a user's standpoint the TTTN requires the user to dial a unique code to access a tie-trunk facility from the user's voice system (e.g., to get a tie-trunk between Springfield and Chicago the user in Springfield dials 8 and the user in Chicago dials 7). A TTTN does not require the State to maintain a unique State directory, but users must remember the particular digits to access certain trunks and those digits can vary from voice system to voice system. In addition, the environment of TTTNs requires users to make routing decisions. For example, to dial Chicago from Springfield the user could dial 8, access the tie-trunk, and then dial the ultimate destination of the call. Or, the user could dial '9' and dial a regular long-distance phone number (217-521-8438). Therefore the user made the routing decision to use tie-trunk facilities or regular long-distance service. The structure of TTTN is illustrated in Figure 3-11.

In the past the alternative to a TTTN has had significant disadvantages to the State, because it requires the State to maintain a separate directory different than the numbering plan used by the nation's telephone companies. Directory maintenance is an onerous and tedious job and typically the State directory is never up to date, meaning that the State must usually provide operators for directory assistance.

With the assistance of the vendors, NSI has developed a second voice network architecture that eliminates the necessity of a separate and unique numbering plan and at the same time moves routing decisions to sophisticated voice switching systems. The State would build a two-level hierarchy, where the highest level of the hierarchy would consist of switches to do routing. At these switches the State would concentrate routing intelligence and network directory databases. End-systems, the lowest level of voice switching nodes, would route calls internal to the system and calls that are in the local calling area. All other calls would be routed to the second level node. The first level node could send up to four possible variations of digits:

- 1-NPA-NNX-XXXX
- NPA-NNX-XXXX
- 1-NNX-XXXX
- NNX-XXXX

The second level switch must be able to receive any one of these sets of digits on any trunk. This voice system would provide a Transparent Uniform Numbering Plan (TUNP), where the dialing procedures to users would be exactly the same as if they were using their telephones at home. Both Northern Telecom and AT&T have verified their ability to support the TUNP network architecture as illustrated in Figure 3-12.

Voice Network Alternative 1: Tandem Tie Trunk Network

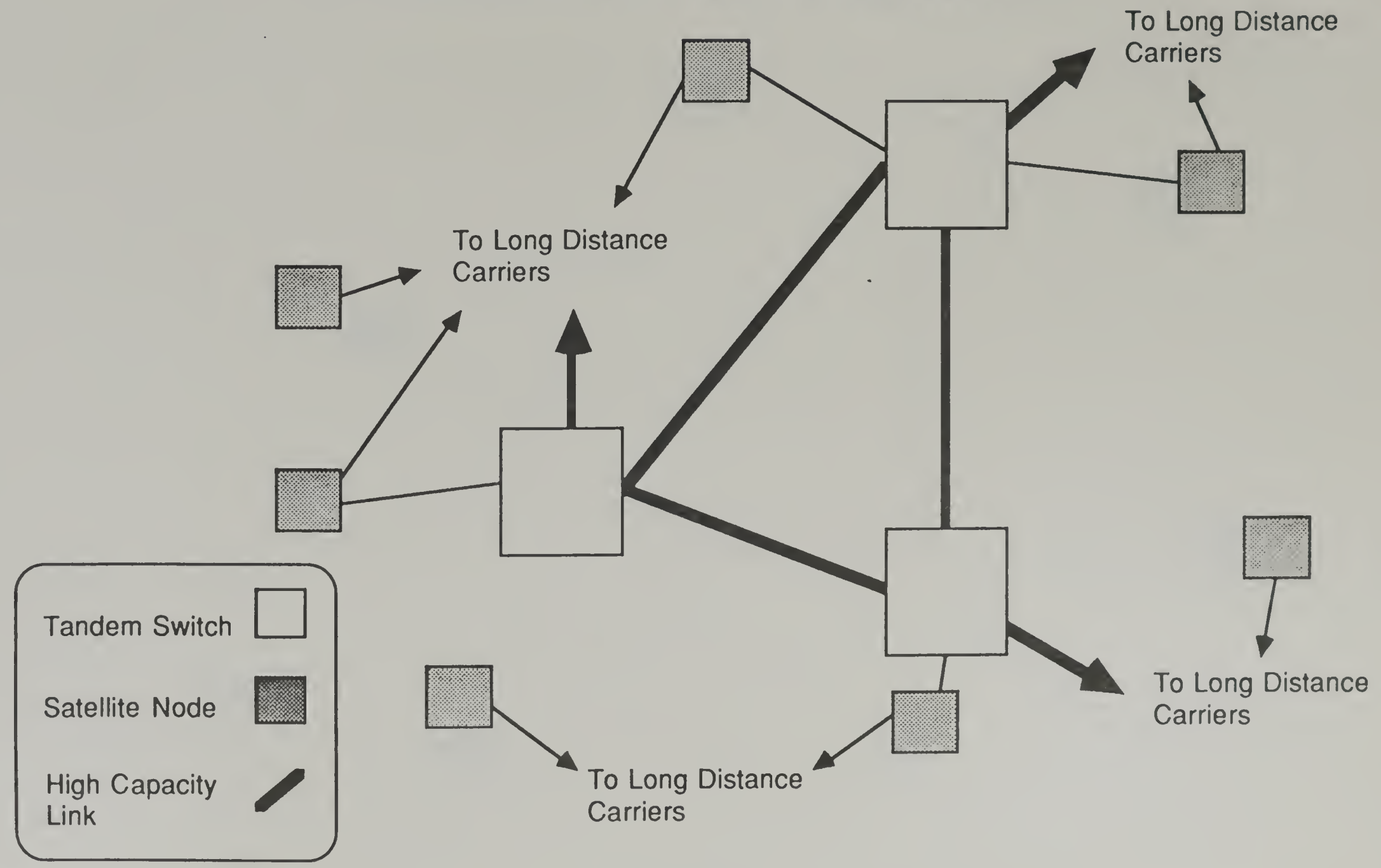


Figure 3-11

Voice Network Alternative 2:
Uniform PSN Transparent Routing

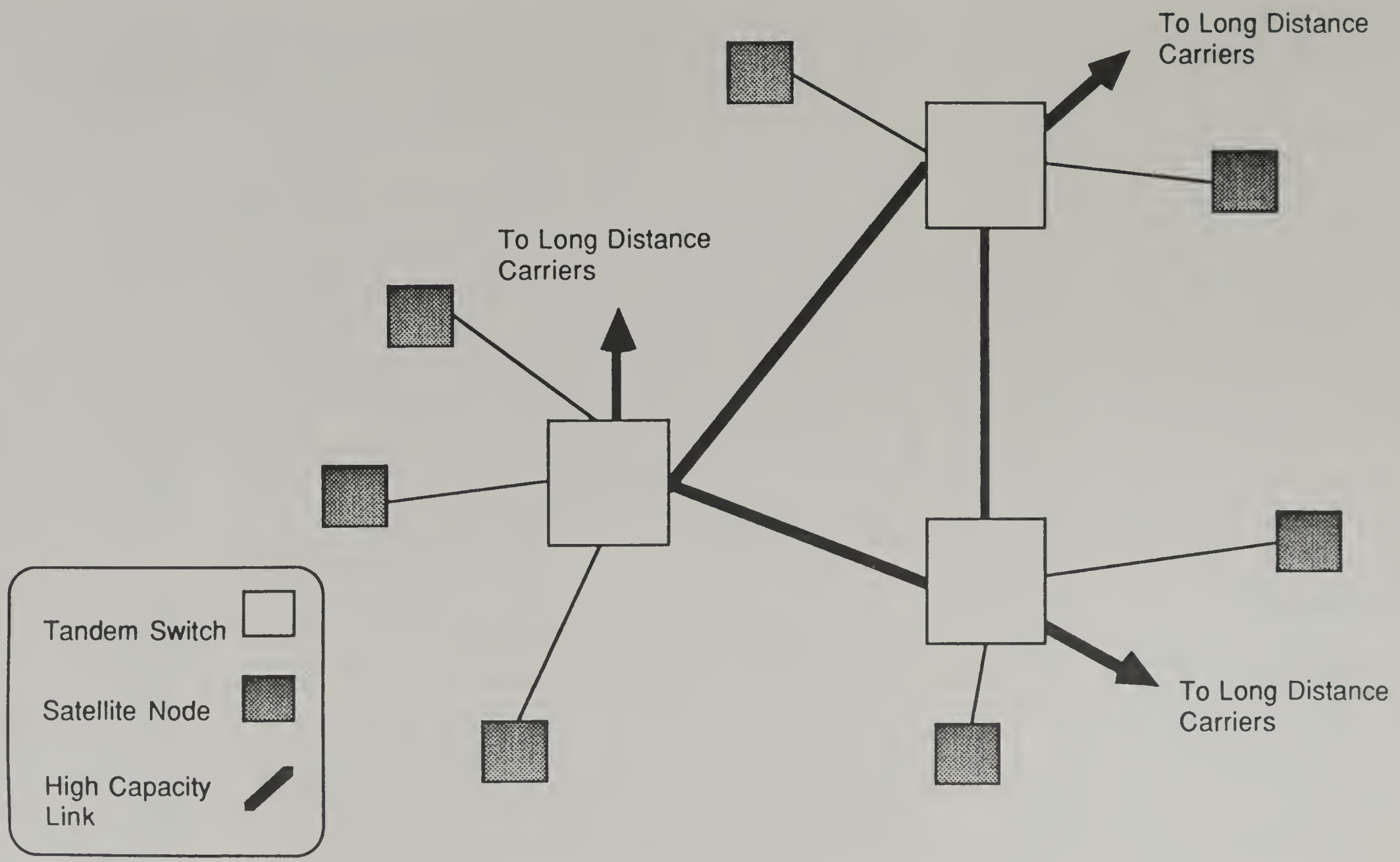


Figure 3-12

3.4.2 Technical Evaluation

The TUNP is superior to the baseline network as summarized below:

- Ease of network management — In this technical category the baseline network is superior to the TUNP because the TUNP requires significant overhead managing the database at the four routing nodes. The baseline network does not have this management overhead. These management costs in personnel time are more than offset by the cost savings achieved by backhauling WATS traffic for bulk calling rates on the major nodes.

- Network performance — The TUNP is vastly superior to the baseline network because it simplifies user's dialing procedures and it moves routing decisions to switches rather than users. Both of these result in a voice network that is easier to use and cheaper to operate.

- Ability to support future requirements — The TUNP positions the State to take advantage of two major voice technology developments, the Integrated Services Digital Networks (ISDN) standards and Signaling System #7 (SS#7) standard. ISDN standards define the interface between telephones and voice switches and between different types of voice switches. The ISDN standards define a voice network architecture for future voice systems. These standards include specification for signaling, maintenance, operation, configuration, and management. When ISDN capabilities are available, the end-user will see faster connection times and better functionality. The SS#7 standard defines how voice switches internal to a network communicate. These standards include signalling, database format, management, and system operation. The requirement for supporting multiple databases in the TUNP voice network is onerous and detracts from the TUNP voice network alternative. SS#7 allows the State to eliminate the multiple databases. Therefore the State could implement one database, that all switches with SS#7 or ISDN interfaces would access to make routing decisions. The ISDN and SS#7 standards also allow the State to eliminate the two-level hierarchy of the TUNP voice network, and thereby improve the routing plan of the TUNP voice network.

- Reliability — From a reliability standpoint, neither option is superior to the other. Both systems are dependent on the same equipment and facilities, which are the basis for all reliability measures.

The added costs for the TUNP, that is, new databases and maintenance of these systems, is more than offset by the cost savings achieved in backhauling Wide Area Telecommunications Service (WATS) to concentrate this traffic for a better price on WATS. The expected cost savings are approximately $3,500,000 over five years, as shown in Figure 3-13.

3.4.3 Recommendations

We recommend the State implement a TUNP voice network to satisfy its voice requirements. In addition, we recommend the State do a pilot test on ISDN and SS#7 standards in the TUNP voice network when feasible. Both of these standards developments will affect the voice network environment and the State could use the experience of the pilot test to implement new technologies based on these standards.

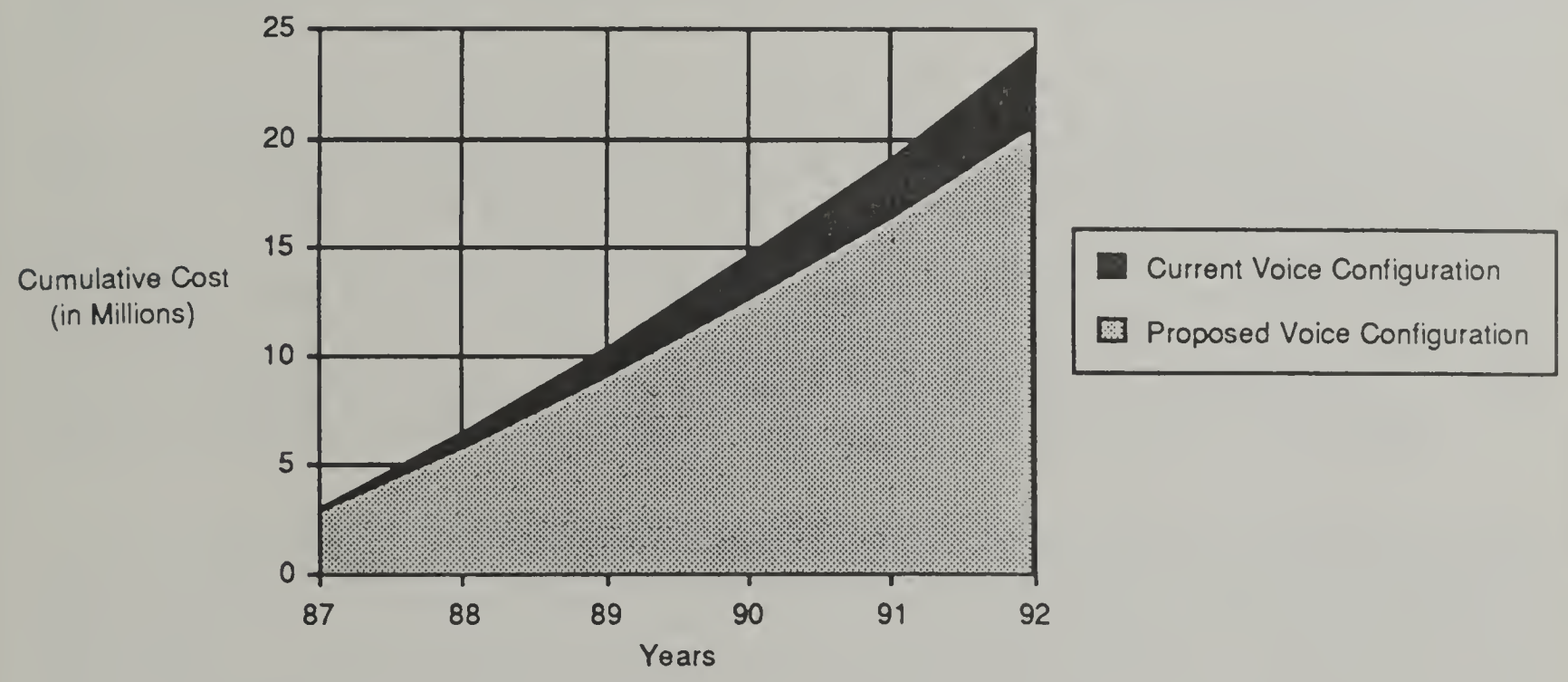
3.5 DATA NETWORK ALTERNATIVES ANALYSIS

In the early networking years, application programmers had to be concerned with all details of managing the communications link between two computer systems or between a computer and a terminal. When programs changed, much of the network had to be redesigned and copious amounts of software had to be rewritten. For example, the current database maintained by the SOS contains embedded communications code and any modification of this program would require significant software development effort. Although reasonable at the time the SOS's database was developed, new systems should use a more modern approach.

In today's networking environment, a semblance of order and modularity have emerged. A computer network architecture defines a set of rules that allow different end systems to communicate with one another. These rules are divided into various layers, and the layers use protocols to communicate between systems. A group of layers can be combined into a single network architecture.

Each computer vendor has their own proprietary network architecture. The State currently has a variety of data networks based on different vendor's network architectures, as described in the Needs Assessment. Examples include IBM's SNA, DEC's DNA, Honeywell's DSA, or Wang's WSN. The largest network is CMS's SNA data network. The next largest system is Lottery's asynchronous network using CDC equipment. All other systems are a mix of protocol types and equipment. Because different vendor's computer network architectures are not compatible with each other, a user organization, such as the State, can have great difficulty interconnecting terminals, workstations, computers, and other systems from different vendors. The end result is a serious restriction of information flow within and between State institutions.

Cumulative Cost of Current and Proposed Voice Configurations



Network Strategies, Inc.

Figure 3-13

The State must define a standard approach for computer system interoperability, which means the State must identify standard computer network architectures.

IBM's Systems Network Architecture (SNA) was the first commercially available computer network architecture, introduced in 1974. Since that time, IBM has announced SNA-compatible software products for all of its mainframe operating systems and front-end processors. SNA-compatible terminals must be intelligent; that is, they must incorporate a processor that can execute the functions required by the architectural layers of SNA. In the case of the popular 3270 interactive display system, an intelligent cluster controller provides these functions for multiple attached keyboard/display and printer units.

In contrast to other computer network architectures, SNA adheres to a principle of strong centralized control of the network by mainframe processors. All session establishment, routing, and network management functions are controlled by one or more host mainframe processors in the network. While SNA once supported only host-centered, tree-structured network topologies, it is now possible to build a packet switching mesh network topology out of SNA products. The lastest versions of SNA allow systems to communicate with one another without the constraints of having to use a mainframe computer.

Of all of the vendor architectures, SNA has been the most successful in terms of user acceptance, to the point where SNA has become a de-facto networking standard. There are many more networks using SNA than any other commercial network architecture. Furthermore, most other vendors have developed SNA gateway products that allow their non-IBM products to participate in SNA networks. CMS has implemented a statewide SNA network. Other agencies have implemented SNA gateway software to communicate with the IBM hosts located in Springfield. Some agencies without SNA gateway software are unable to communicate with CMS.

In reaction to the dominance of SNA, independent standards groups have been actively developing network architecture guidelines for multi-vendor communications. These groups include the International Standards Organization and the Consultative Committee on International Telegraphy and Telephony (CCITT). Collectively they have promulgated the concept of an open architecture based on a standard reference model, called Open Systems Interconnection (OSI). This approach is intended to permit each vendor's computer devices and systems to be open to communications and cooperation with all other vendor's devices and systems.

The OSI architecture combines many of the best features of commercial computer network architectures, such as IBM's SNA and DEC's DNA, while allowing flexibility for future functional enhancements. Data communications functions in a network supporting the OSI architecture are distributed within seven architectural layers. These layers, in top-down order, include the application layer (7), presentation

layer (6), session layer (5), transport layer (4), network layer (3), data link layer (2), and physical layer (1). Standards for the lower three layers have been essentially agreed upon and implemented in a number of vendor's products (for example X.25).

X.25, a recommendation promulgated by the CCITT, defines how different systems should connect to a packet-switching network. Almost all of the computer vendors, including IBM, provide X.25 support for some of their communications products. The vendor's X.25 products allow the vendor's proprietary architecture to ride on top of the X.25 protocols or allow communications to terminals using special interface equipment. Therefore, the OSI/X.25 standards suite is a competing standard with SNA.

3.5.1 Alternatives

The State has two major alternatives for providing data network connectivity, 1) an SNA network side-by-side with an X.25 packet switching network, and the large installed base of SNA equipment would be the SNA backbone, where non-SNA traffic would use the X.25 packet switching network, or 2) the State could implement a statewide packet switching network based on X.25 and all traffic, SNA and other vendor's computer systems, would use the X.25 backbone. The topological structure of both of these alternatives is illustrated in Figures 3-14 and 3-15.

3.5.2 Technical Evaluation

A summary of the two data network options is described below:

- Ease of network management — The SNA/X.25 data network option is superior to the X.25 backbone network option because network management in the latter option requires the network manager to coordinate between two different data systems to isolate failures or to identify network problems. When SNA and X.25 operate side-by-side, end-systems will be using one or the other data network, but not both. Therefore, network management is greatly simplified.

- Network performance — The X.25 backbone has significant performance problems. All SNA systems go through two levels of switching before reaching their ultimate destination. Flow control parameters in the SNA network have to be changed to reflect the additional level of switching. Thereby causing even worse performance. In contrast, SNA and X.25 side-by-side perform very

Data Network Alternative 1: SNA Over X.25

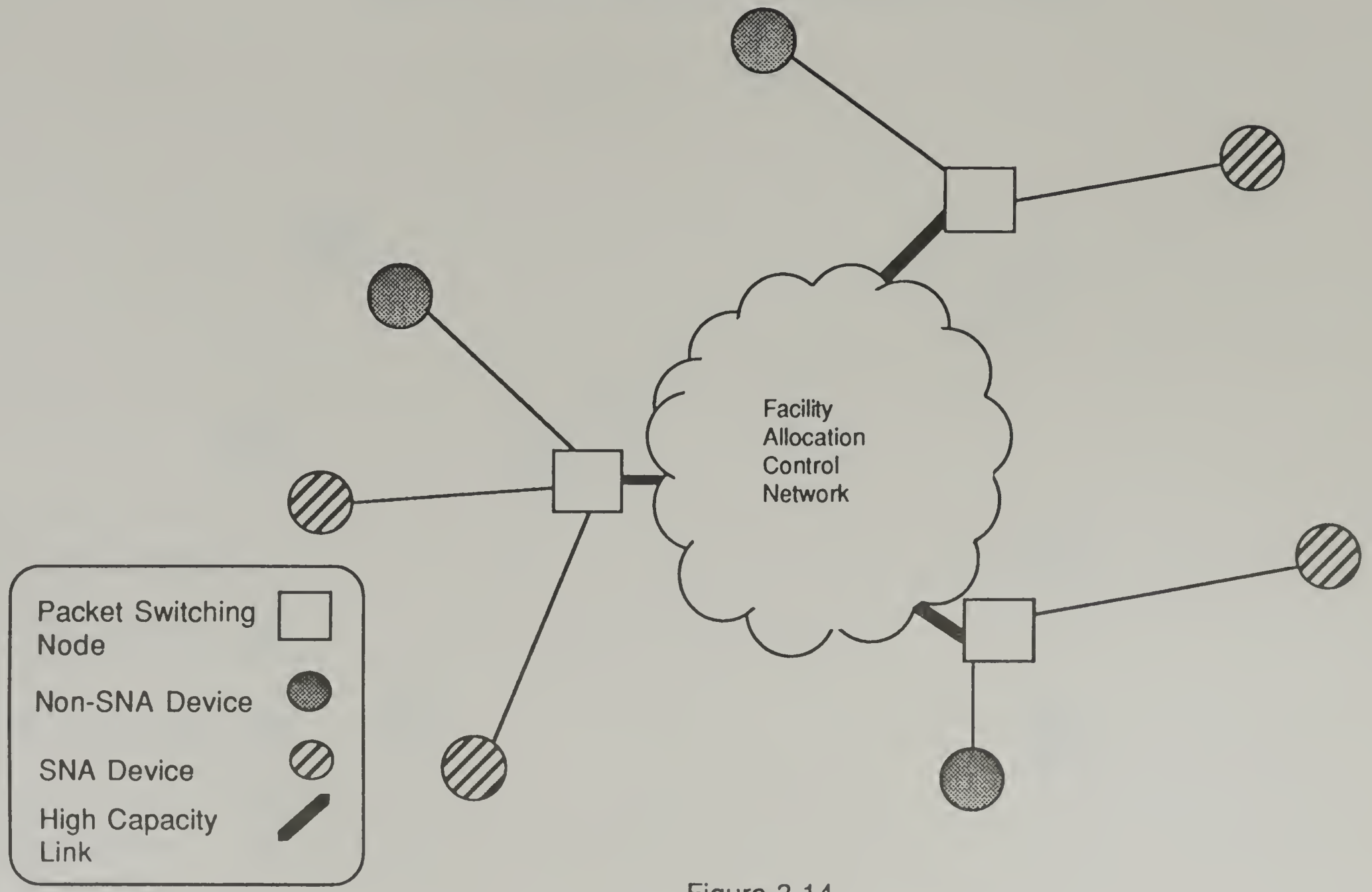


Figure 3-14

Data Network Alternative 2: SNA and X.25 "Side by Side"

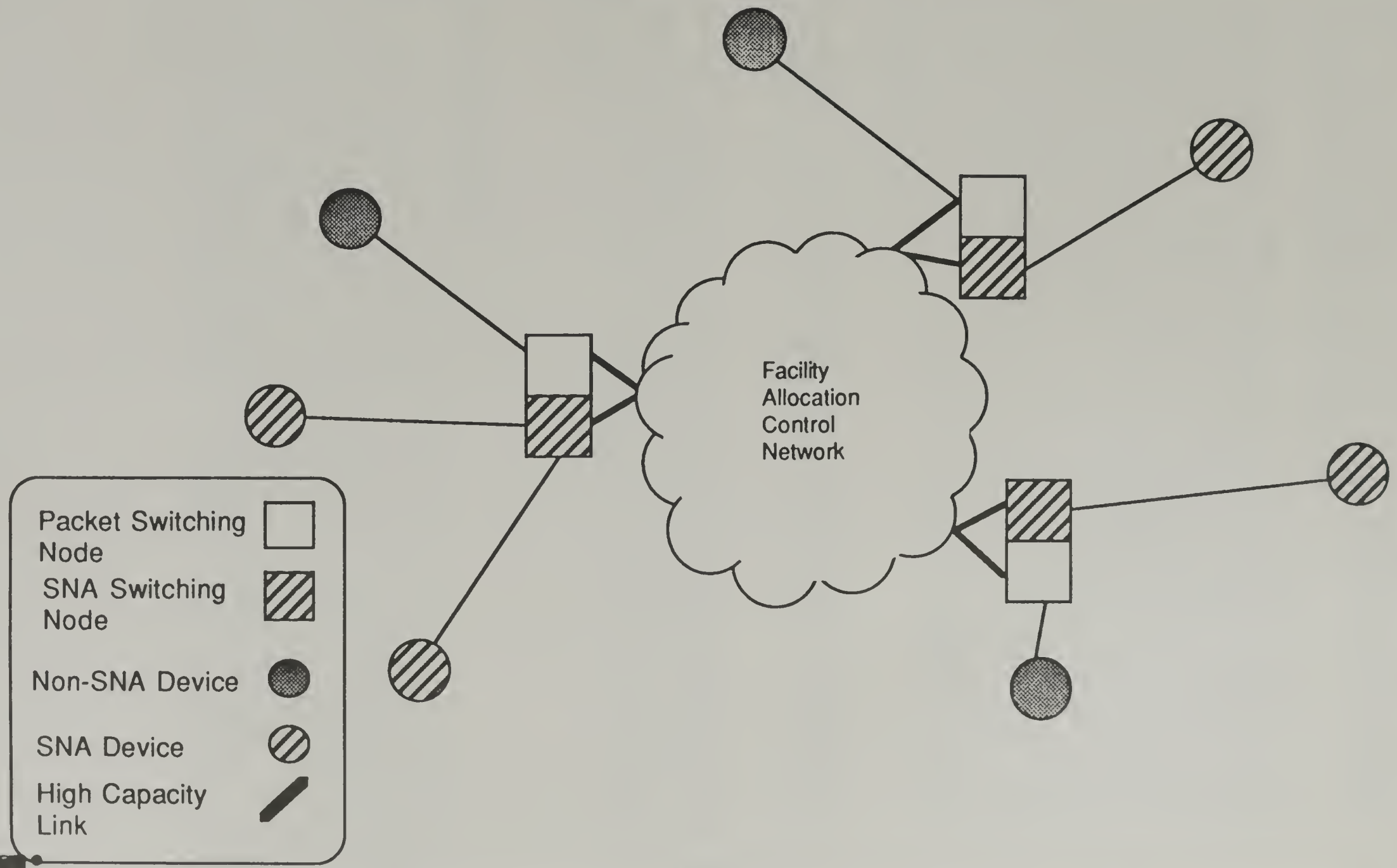


Figure 3-15

well. For those systems that use SNA, SNA protocols are the most efficient and provide better performance over any other protocol suite. Non-SNA systems that use X.25 have very little overhead, and therefore operate relatively efficiently.

- Ability to support future requirements — The X.25 backbone limits the flexibility of upgrading SNA networks, because all switching must be done through the X.25 network. With SNA and X.25 side-by-side, the SNA users can take advantage of new peer oriented protocols, and non-SNA systems gain all the advantage of sophisticated X.25 switching. With SNA and X.25 side-by-side the State has greater flexibility in the evolution of SNA equipment. The State can begin implementing higher level OSI protocols on top of X.25 and encouraging different agencies to migrate their data network architecture to either SNA or OSI/X.25. The State could then implement SNA to OSI gateways for various applications, and thus support statewide interoperability between different agency's computer systems.

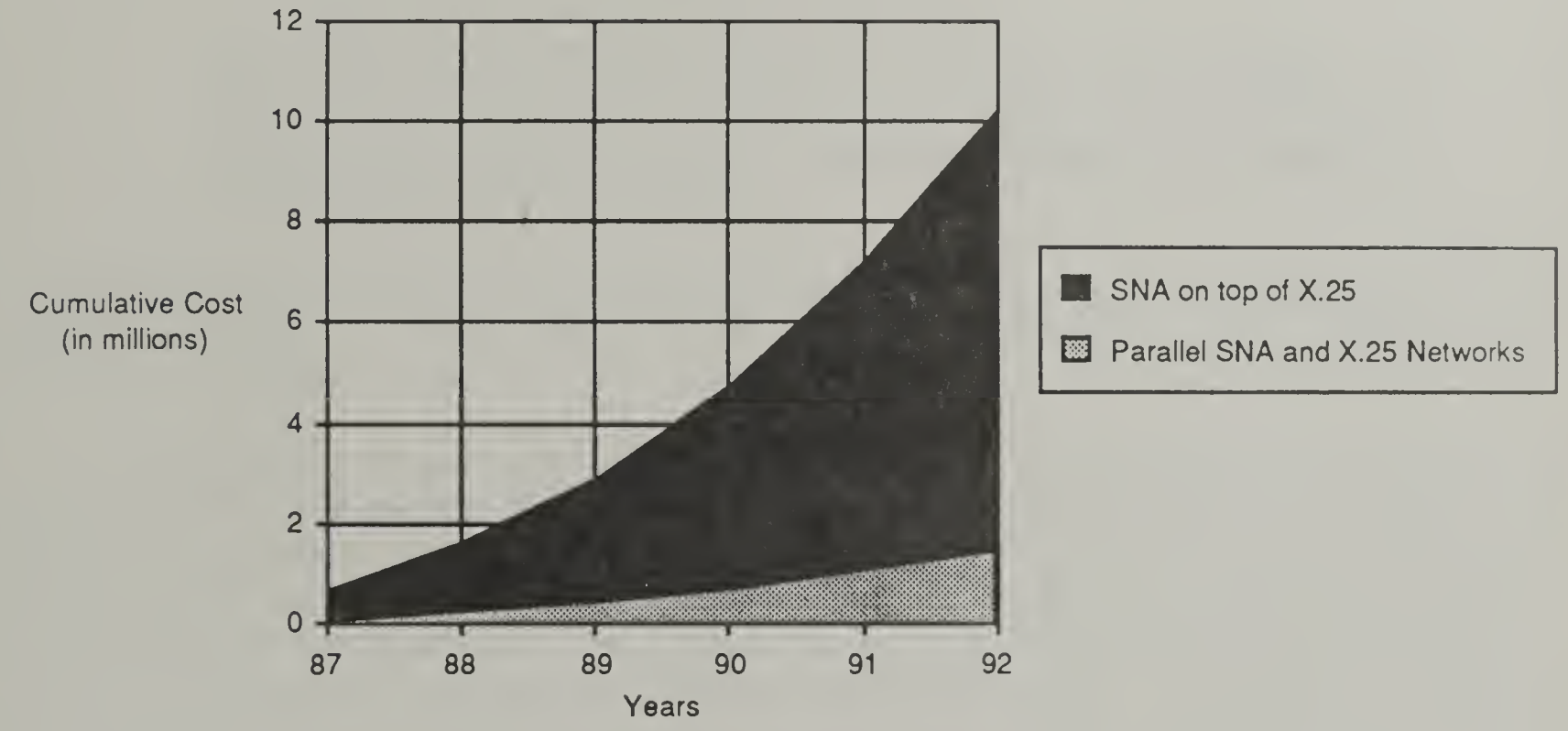
- Reliability — Both alternatives are equally reliable, because they provide for mesh network configurations with diverse route switching capability.

The expected cost savings of the SNA and X.25 side-by-side option over the X.25 backbone option is $8,500,000 over a five year period, as shown in Figure 3-16. The major reason for the cost difference is the cost of buying two switches, an SNA communications processor and an X.25 switch, as compared to only one switch in the side-by-side option.

3.5.3 Recommendations

We recommend the State implement side-by-side SNA and X.25 data networks to satisfy its data switching requirements. This will allow the State to leverage its embedded base of SNA equipment and simultaneously to begin positioning to support the OSI system by implementing X.25. The State should continue to upgrade the SNA system as appropriate. In addition, we recommend the State do a pilot test on gateway applications between different vendor computer network architectures. Specifically, the State should test applications between SNA and OSI/X.25 systems. The State could use the experience of the pilot test to implement new technologies based on these standards.

Cumulative Cost of Alternative Data Networks



Network Strategies, Inc.

Figure 3-16

3.6 POTENTIAL ADDITIONAL COST SAVINGS

Local access or "last mile" transmission facilities are a major, and increasing component of the cost of any telecommunications network. Most users have limited choices in optimizing their access network configuration. The recommended network architecture, however, will allow the State to consider a wide variety of cost saving options. Some of the possible options the State could use are listed below:

- Alternative local transmission technologies, such as microwave, CATV, or local fiber. In sites with a heavy concentration of traffic these technologies can reduce cost by over 50%.

- More optimal local configurations taking advantage of any common user locations. The State could design Metropolitan Area Networks (MANs) for the major cities, taking advantage of the heavy concentration of traffic within a single metropolitan area. The City of New York expects to save over 40% on its local transmission costs by using Local Area Data Services (LADS).

- On-premise multiplexing to reduce the number of local circuits. In the university environment, the traffic can be concentrated within the site and the university can then present one single high bandwidth interface to the intercity network.

A backbone network effectively decouples the access network from the backbone, and allows the State to independently plan, design, and procure each segment to maximize savings.

The second major way of saving money is to use advanced compression technology to decrease the bandwidth requirements of voice and data. For voice, the State could consider implementing a compressed voice algorithm, such as Adaptive Differential Pulse Code Modulation (ADPCM), that would decrease the bandwidth requirements for voice by half. The State currently uses ADPCM technology in several of its T1 multiplexer links between Chicago and Springfield. In addition, the State could use more sophisticated compression algorithms for video. Newer systems have the capability to compress video signals to 1/4 of a T1 or even 56 kbps.

4.0 MANAGEMENT ANALYSIS

It is clear from the Architectures Analysis that a state-wide integrated network for the State of Illinois is technically feasible and economically attractive. In developing such a network, however, the State must consider several management issues that will affect the success of the ultimate system:

- Ownership of transmission facilities
- Responsibility for systems integration
- Operation of the telecommunications network
- Procurement strategies
- Planning for growth and future applications

This chapter presents the recommendations developed by NSI in conjunction with the Blue Ribbon Committee and the many participants from user agencies within the State of Illinois.

4.1 OWNERSHIP OF TRANSMISSION FACILITIES

One of the fundamental decisions faced by large users of telecommunications concerns the ownership of transmission facilities. In this context, transmission facilities refer to the actual physical assets that are used to convey telecommunications traffic as electrical signals. For instance, the State currently owns a number of microwave towers, along with microwave transmission and reception equipment. The State, therefore, has complete control over the use of and attachment to the microwave equipment. On the other hand, the State obtains most of its transmission capacity via tariffed carrier services, in which the State receives a channel capable of transmitting at a defined data rate. Subscribing to a tariffed or leased service does not give the State ownership, or even access to, the basic used by the carrier to provide the service.

4.1.1 Alternatives

The State has two primary ownership alternatives: 1) develop a network based primarily on State-owned transmission facilities, or 2) develop a network based primarily on carrier-provided transmission facilities. In either case, the State could obtain transmission facilities along specific routes using the alternative method. For instance, should the State decide to procure the majority of its transmission facilities from a communications carrier or carriers, it could still purchase and own certain

transmission facilities that are part of the state-wide network. Examples of both approaches can be found within the existing State government environment. A partial list of approaches taken by other states is illustrated in Figure 4-1.

4.1.2 Considerations

To make a decision regarding the ownership of the transmission facilities, we feel the State must consider three primary factors:

- Technical and Financial Risk - If the State assumes ownership of transmission facilities, then it must bear the technical risk involved with developing a network based on evolving technologies. The State must also be prepared to make the sizable capital investment that is typically required to install transmission facilities, and must carefully plan for future use of the system to ensure that the owned transmission facilities are neither over- nor under-utilized.

- Impact on Business Climate - Ownership of a large transmission network could put the State in a position of competing with telecommunications carriers within Illinois. This situation could become contentious if the State attempted to resell excess capacity on a State-owned network. Development of a carrier-owned network, on the other hand, could spur the installation of modern telecommunications facilities throughout the State of Illinois and increase the telecommunications carrier's capability to serve the Illinois business community.

- Cost - There is not likely to be a major cost difference between a State-owned or carrier-owned network. The cost to install the facilities themselves should be identical. The major cost difference is likely to be based on the cost of financing between the public and private sectors. The cost of financing would be expected to be lower for the State, resulting in a possible lower cost. Offsetting that, however, are the economic incentives of a carrier to leverage the State's commitment to large-scale transmission facilities into a new set of service offerings for the business community and general public. The State of Indiana, for example, has found that its selected

State Telecommunications Systems (Operational and Proposed)

STATE	OWNERSHIP	VOICE	DATA	TELECONF.	TV	TECHNOLOGIES
Alaska	State	√	√	√	√	Fiber optics, broadcast radio, satellite
California	Leased	√	√			Fiber optics, microwave
Colorado	Leased	√	√	√	√	Fiber optics, microwave, broadcast radio, satellite
Connecticut	Leased	√	√	√	√	Fiber optics, microwave, broadcast radio
Florida	Leased	√	√	√		Fiber optics, microwave
Georgia	State/Leased	√	√	√	√	Fiber optics, microwave
Hawaii	State	√	√	√	√	Fiber optics, microwave, ITFS, broadcast video
Illinois	Leased	√	√	√	√	Fiber optics
Indiana	Leased	√	√	√	√	Fiber optics, microwave, ITFS
Kentucky	State	√	√	√	√	Fiber optics, microwave
Louisiana	Leased	√	√			Fiber optics
Maryland	State	√	√	√	√	Fiber optics, microwave, ITFS, broadcast radio, satellite, broadcast video
Massachusetts	Leased	√	√			Fiber optics, microwave
Missouri	Leased	√	√			Fiber optics, satellite
Montana	Leased	√	√	√	√	Fiber optics, microwave
Nevada	State/Leased	√	√	√		Fiber optics, microwave
New Jersey	Leased	√	√	√	√	Fiber optics, microwave, ITFS
New York	State	√	√	√	√	Fiber optics, microwave
North Carolina	State	√	√	√		Fiber optics, microwave, ITFS, broadcast video
North Dakota	Leased	√	√	√		Fiber optics, broadcast radio
Ohio	State	√	√	√	√	Fiber optics, microwave
Oklahoma	State	√	√	√	√	Fiber optics, microwave, ITFS
Pennsylvania	Leased	√	√	√		Fiber optics, microwave
South Carolina	State	√	√	√	√	Fiber optics, microwave, ITFS, broadcast radio, satellite, broadcast video
Tennesses	State	√	√	√	√	Fiber optics
Texas	Leased	√	√	√		Fiber optics, microwave, broadcast radio, satellite, broadcast video
Utah	State/Leased	√	√		√	Fiber optics, microwave
Wisconsin	Leased	√	√	√	√	Fiber optics, microwave, ITFS
Maine, New Hampshire, Vermont						No system in place

Table 4-1

Reprinted from an Educational Telecommunications Transmission Network for Vermont, Dec. 1986

vendor, GTE Telecom, Inc. (GTI), was willing to install a state-wide fiber optic network and absorb most of the construction cost because of the possible business opportunities a fiber optic network would provide. Indiana's minimum commitment gave GTI financial justification to undertake the risk of building the network with the expectation that additional business would result.

4.1.3 Recommendation

We recommend that the State base its network primarily on carrier-owned transmission facilities. This strategy does have the flexibility, however, to allow the State to selectively own certain portions of the transmission facility backbone. We recommend that the ownership option be pursued only if 1) very large, short term cost savings will result, or 2) it is necessary to guarantee performance of essential State government functions.

4.2 RESPONSIBILITY FOR SYSTEMS INTEGRATION

Systems integration refers to the set of activities necessary to ensure the successful installation and operation of a complex telecommunications network. Systems integration is becoming more important in the era of telecommunications deregulation, since it is no longer possible for large users to obtain a complete, end-to-end service from the traditional telephone carriers. In addition, the increasing pace of new technologies and services has made the possible combinations of the facilities, equipment, and software almost endless. Systems integration is that essential task of selecting the network pieces and making them work together as a coherent whole.

4.2.1 Alternatives

In developing a State-wide network, the State may select from three systems integration alternatives:

- The State may perform all systems integration
- The State may select a systems integration contractor but maintain ultimate responsibility

- The State and a contractor may each be responsible for portions of the network

The following paragraphs discuss the considerations involved in systems integration and our recommendation.

4.2.2 Considerations

The State must consider four primary factors in evaluating the alternatives for systems integration responsibility:

- Staffing Impact - Systems integration is a staff-intensive activity with a relatively short duration. We expect that a state-wide network would be implemented during a twelve to eighteen month period, and during this period, staff activity would be intense. If the State performs all systems integration activities internally, then it would have to recruit substantial numbers of new technical staff members quickly. In addition, technical staff members with the experience and skills needed for systems integration work are relatively scarce and may be difficult for the State to recruit. After the integration process is completed, the new technical staff members would be severely underutilized.

- Technical Capabilities - Although the State maintains a sizable and skilled telecommunications staff, the special skills and experience needed to successfully pursue a large systems integration project would have to be acquired. Our experience with Federal, state, and local governments indicates that personnel skilled in systems integration are difficult to acquire and retain. These individuals tend to gravitate towards firms that are in the business of implementing large telecommunications systems.

- Technical Risk - The implementation of a large telecommunications system involves the integration of many diverse products and technologies, and implies some degree of technical risk. The party responsible for a state-wide network must be willing to undertake the risk that some of the selected network components may not perform properly, and it must have the resources to take necessary corrective actions.

- Cost - The cost differences for systems integration activities during network implementation are not likely to vary significantly among the alternatives. Once systems integration is complete, an integration contractor may be released; However, new State employees acquired expressly for systems integration may be more difficult to divest.

4.2.3 Recommendation

We recommend that the State retain ultimate responsibility for directing systems integration, but engage a systems integration contractor to perform systems integration. This strategy will allow the State to maintain control of the process, without requiring a large recruiting effort. We also recommend that State personnel continue to develop the current telecommunications systems until they are integrated into the state-wide network, and that the integration contractor be responsible for developing the entire backbone network. This approach will allow the current telecommunications systems supporting state government functions to continue to operate independently until the new network is available, and will provide a clear division of responsibility between the State and its systems integration contractor.

4.3 OPERATION OF THE TELECOMMUNICATIONS NETWORK

Another management issue facing the State in the development of a state-wide telecommunications system is the placement of operations responsibility. In this context, operations refers to the day-to-day activities required to provide service to users, which includes controlling network equipment and facilities, and resolving network problems. Examples of network operations include:

- Assigning channels on a wideband transmission facility backbone
- Updating the telephone number tables in a voice switching system
- Adding new terminals or users to a data communications network
- Isolating link failures to determine their cause

These activities are commonly performed by State employees for the voice and data communications networks now in place.

The issue is more complicated in a state-wide, shared user network. A shared user network can be thought of as a two level network the transmission facilities and the facility allocation control system, which constitute a basic network that provides transmission services to individual user community networks. For instance, the networks currently operated by the Secretary of State or the Department of Lottery could use transmission services provided by the state-wide network, but still maintain independent operation. In this sense, a state-wide shared network acts as a carrier to State agencies. The State thus faces two types of operations choices: 1) responsibility for operation of the underlying shared facilities network, and 2) operation of the user agency networks that use the shared facilities.

4.3.1 Alternatives

Several alternatives are technically feasible in the operation of either the underlying transmission facilities network or the user agency networks:

- Operation of the underlying transmission networks and user agency networks by State personnel

- Operation of the underlying transmission networks by contractors and operation of the user agency networks by State personnel

These two alternatives are analyzed in the following sections.

4.3.2 Considerations

The State must consider three primary factors in evaluating the alternatives for operations responsibility:

- Responsibility for Government Functions - Many essential government functions, such as law enforcement, public assistance, and tax collection, are highly dependent on telecommunications. Thus the agencies responsible for these functions may legitimately feel that they must control their telecommunications resources.

- Control of Priorities - Many large users have retained operational control over their telecommunications resources because they wish to maintain control of service priorities. Users whose businesses or vital government functions rely on telecommunications, in many cases, feel that they do not want to yield operations responsibility to

vendors who have many customers to serve and a finite amount of resources. Such users feel that they need to ensure that they will have control over the prioritization of service and available resources.

- Cost - Many state and Federal government users, have found that contracting for system operations has reduced their operating costs and eliminated the necessity to make investments in the personnel and facilities needed to successfully operate large telecommunications systems. Such users are usually new to the world of telecommunications and have no existing telecommunications management infrastructure. The State of Illinois, however, operating its own telecommunications systems; therefore, it is unlikely that any significant cost savings would result from contracting for telecommunications system operations.

4.3.3 Recommendations

We recommend that the State be responsible for operation of telecommunications systems. This policy will benefit the State by assuring control of the State's resources and operational priorities. Since it is unlikely that contracting for this activity will yield significant cost savings, we see no advantage to doing so, unless the State wishes to obtain contractor support to augment its existing staff. In such a case, we recommend that State personnel maintain direct control over the activities of any contractor support personnel, and that the responsibility for telecommunications operations remain with the State.

4.3.3.1 Operation of the Backbone Network

In our experience the basic transmission facilities that constitute the backbone network, as well as shared switching resources such as the SNA/X.25 data switching system, must be centrally managed and operated. Central management is required to streamline capacity planning, to ensure timely resolution of problems, and to ensure optimum system performance. The backbone network should be provided as a service to user agencies, with the agencies using the service just as they would procure services from telecommunications carriers. Central management is essential to providing a high quality service to users.

4.3.3.2 Operation of User Agency Data Networks

Several options are available to user agencies regarding the operation of their data networks. It is quite reasonable and feasible for a user agency to obtain transmission services from the state network and continue to operate its network as before. For instance, the University of Illinois Champaign campus has a large SNA data network with circuits between Champaign and Chicago. It would be possible for the University to obtain high capacity facilities from the state network, just as it does now from AT&T, and continue to operate its system as it does now. The only differences in operation would be that transmission services were obtained from the state network, and that the cost to the University would be substantially reduced. The University could still exercise full control over its host, front end processors, and terminals in exactly the same manner as it does now.

It is also possible for user agencies to merge their networks with a shared SNA or X.25 network. If a user agency felt that the burden of network management was becoming unreasonable, that agency could allow the central state network backbone manager to manage its network resources as well. In the SNA environment, the most efficient way to accomplish this would be to use SNA Network Interconnection (SNI), a product that allows SNA networks to connect using gateways without interfering in each others operations. Using SNI, a user agency could simply redefine its terminals as part of the backbone network, in which case they would be managed by the backbone manager. The user agency would retain control of its host, and could in fact control local terminals attached to that host. This course of action is currently being implemented by the City of New York in its metropolitan network.

As an alternative the state could use SNI gateways to interconnect different user agency networks while not affecting the management of each individual network. For instance, an SNI gateway can be established between the University of Illinois' network and the CMS network, thus allowing users of each system to access selected applications on the other system. CMS currently uses SNI for exactly this purpose, with gateways to five other SNA networks, including the State of Missouri and Martin Marietta. SNI gateways in the SNA community would allow interconnectivity between different systems without changing the management and operations strategies of any user agency.

Agencies that use the backbone X.25 network would experience a slight change in their operations. It is quite possible for a user agency to retain control of its host, front end processors, and terminals using a centralized X.25 network. However, only the manager of the X.25 network can monitor and control the resources. Problem resolution, moves, and changes would require coordination between the user agency and the X.25 network manager. The nature of the coordination required is no different

than that now required between a user agency and telecommunications carriers, and could be simpler since the user agency would be dealing with a network whose only purpose is to provide service to State government agencies.

4.3.3.3 Operation of the State Voice Network

Operation of a voice network with a Transparent Uniform Numbering Plan (TUNP) will require more central planning and coordination than now exists in the voice area. The "routing nodes" in the network will require current databases of all telephone numbers used by State government personnel and a complete topology of the network. These databases will require frequent updating. It is also vital that the databases maintained by the routing nodes be identical. Thus close coordination among the routing nodes will be required. Central management of the routing nodes is the easiest way to achieve the necessary coordination, but it may also be possible to coordinate the necessary database changes among several agencies. The analysis in this study has indicated that four routing nodes are appropriate: Chicago, Springfield, Urbana/Champaign and Carbondale. The first two nodes are already under common management; however, the Urbana/Champaign and the Carbondale nodes are expected to be under University management and are primarily expected to serve the needs of these campuses.

If the necessary day-to-day coordination required among routing nodes is impractical to achieve with the two University switches, an identical result could be obtained by colocating a dedicated tandem switch with each University node. In this case, the tandem switches would contain the central database, and would be managed centrally along with the other routing nodes. The two university switches would connect to the routing node as an end user, and could be independently managed without affecting the operation of the central voice backbone. This approach is being implemented by the State of Indiana in its state-wide network, Intelenet.

4.3.3.4 Operation of User Agency Voice Switches

Voice switching systems operated by user agencies will require route selection programming to operate in the State's voice network, if the TUNP network option is selected. In particular, the switch's automatic route selection (ARS) tables will need modification. Other than this modification, user agency voice switches should not require any change in operations strategy.

4.4 PROCUREMENT STRATEGIES

Once the State has selected the technical and management options to be included in a state network, it then must determine the best method to procure the required services and facilities. Large telecommunications users have found that new and creative procurement strategies that take advantage of competition in the telecommunications industry have resulted in significant cost savings, additional benefits, and a shifting of the technical and financial risk away from the procuring party.

There are two fundamental issues that must be decided before the State can proceed with procuring a state network:

- The degree of bundling desired
- The scope of the procurement

The first issue, bundling, refers to the number and types of services to be included in a single procurement, and the second issue simply defines the items to be procured. The degree of bundling in the procurement of a state network has considerable impact on the financial leverage available to the State. In general, larger packages will result in better terms. However, there may be situations where bundling dissimilar items will not produce any financial advantage and may result in an inferior overall system.

4.4.1 Alternatives

Chapter 3 of this report identified five components of a state network that could be procured separately, but that also have potential for cost savings from bundling: transmission facilities, facility allocation control, circuit switching (which includes the voice network), packet switching (which includes SNA and X.25), and systems integration support. The State could choose to bundle any group of these network components.

4.4.2 Considerations

The State needs to consider three primary factors in selecting a bundling approach and the scope of the procurement:

- Technical Suitability - The degree to which the network components identified earlier "fit together" is one of the considerations in determining the degree of bundling that is reasonable. For example, if two components of a network must work together

integrally, it may make sense for them to be bundled. Bundling in such a case should produce a more cost effective solution and should reduce technical risk by making the same party responsible for the integration of the bundled components. An example of technical suitability might be the bundling of the transmission facilities with the facility allocation system. These two components must work together and provide the user with a "seamless" interface. Bundling them together would tend to promote tight integration, make a single vendor responsible for all the transmission services, and reduce cost by eliminating duplication of effort that could occur if several contractors provided the required services.

- Industry Competition - It is generally desirable to package a procurement in a way that allows a reasonable number of firms to bid. This approach maximizes the financial leverage of competition and provides the State with a broader selection of technical capabilities. Thus, excessive bundling may actually restrict competition, since a small number of firms would be capable of supplying every component of the network. The State should account for the effect on industry competition of its bundling strategy, and should encourage competition by bundling in industry sectors where relatively few competitors exist. In other industry sectors where intense competition exists, the State may not need to bundle network components together to reap the benefits of competition.

- Suitability of Vendor - Very few vendors will have the capability of providing all of the components of the network from their own product lines, and even those who can are unlikely to be capable of offering the best technical approach for every network component. Thus, it may be in the State's interest to unbundle certain parts of the procurement to encourage vendors with certain outstanding qualifications who would not be capable of bidding the entire system.

The other issue central to structuring a procurement is the scope of the services or facilities to be procured. Simply put, the State must define how much and what it desires to procure. This issue is also related to the prior discussions of ownership, systems integration, and operations, since the decisions on those issues shape the decision on the scope of the procurement. In addition, the State could select from the list of network components discussed above and could decide to procure all of them, or a selected subset. Many procurements address this issue by providing for procurement options, which usually consist of a base procurement and additions that

may be selected upon contract award. In any case, the scope of the procurement must be decided prior to entering into a contract with a selected vendor.

4.4.3 Recommendations

4.4.3.1 Bundling of Components

We recommend that the State bundle at least the transmission facilities and the facility allocation system into a single procurement. Bundling these two items together should promote tight integration, make a single vendor responsible for all the transmission services, and reduce cost by eliminating duplication of effort that could occur if several contractors provided the required services. If the State bundles the procurement of all transmission facilities and facility allocation control, the State encourages bidders to build digital facilities to remote portions of the State that probably would not get digital service for a decade or more. The State of Indiana, for example, encouraged the development of fiber optic transmission facilities throughout the eastern part of the State, which was not scheduled for digital service until after 1995.

Bundling of the additional components, voice networking and data networking, is possible, but it is not clear that substantial additional cost savings will result. In particular, the data switching marketplace is sufficiently competitive that the State should receive the benefits of competition without bundling packet switching with the transmission facilities procurement. Bundling the voice switching component with the transmission component may serve to restrict competition because so many of the current voice systems are Centrex systems operated by local exchange carriers.

4.4.3.2 Services or Facilities to Be Procured

We recommend that the State procure all the components identified above, including:

- Transmission facilities or services
- Facility allocation control system
- TUNP voice network
- X.25 packet switching
- SNA data networking
- An appropriate video system
- Systems integration support

The exact numbers, types, and specifications for the components need to be defined before a Request for Proposals can be released. This effort, which is beyond the scope of this Strategic Telecommunications Network Plan, should be pursued in the very near future if the State intends to proceed with the development of a state-wide network.

4.4.3.3 Procurement Strategy

We recommend that the State pursue a strategy of selective bundling, with multiple options. The major portion of the procurement should combine the transmission facilities, the facility allocations control system, and the systems integration support required to implement these two components. These three items should be bundled together and offered as the primary component the Request for Proposals. If other components are procured separately, system integration to support it should be procured at the same time.

The remaining components should be procured as options to the main procurement, with the State retaining the right to procure any of them separately. This approach will allow the State to determine if the financial leverage resulting from bundling the X.25 packet switching, the SNA data networking, and the voice network is beneficial. The State will also have the flexibility to not select any option, if it feels that the offeror's approach for that option is inferior to what could be obtained through a separate procurement. This approach offers the State the financial benefits of bundling, while protecting the State's ability to select the best approach for each of the components.

We also recommend that bidders be allowed to bid on different options, as well as the entire procurement package. Thus, a vendor with strengths in packet switching could bid just that option, while a large, integrated supplier could bid all options. This approach, while complicating the evaluation process, offers the State the best selection of technical approaches, and maximizes the competition for each network component. However, all bidders should be required to provide systems integration support for their portion of the network.

4.5 PLANNING FOR GROWTH AND FUTURE APPLICATIONS

The final management issue facing the State in a committment to a statewide telecommunications system is the accommodation of growth and future applications. In this context, growth refers to increases in both the number of locations the network serves and the traffic load which is placed upon it. Future applications contribute to

growth, but in addition place demands on the felxibility, modularity, and upgradeability of the network itself.

The State has only one realistic avenue for ensuring that the network remains capable of supporting future requirements: the State must centralize the planning function. This centralization can take the form of a standing committee responsible for high-level planning and a planning group responsible for day to day administration.

The State has already established a Blue Ribbon Committee that is responsible for developing the State's long-term telecommunications strategy. A committee such as this could continue to provide valuable input to the planning process. The State has also established a working group tasked with devleoping the Strategic Plan. This working group could continue to address issues which arise in the day to day administration of a coordinated statewide communications network.

We recommend that the State establish a permanent Steering Committee responsible for guiding the State's long term communications strategy. We also recommend that a permanent planning group be established and tasked with defining and executing the activities required to meet the strategic goals established by the Steering Committee.

5.0 TRANSITION PLAN

The recommended network architecture presented in Chapter 3 and the management approach identified in Chapter 4 together represent the most appropriate strategic direction for the State's network services and transmission facilities. Consistent with these recommendations, this chapter presents a transition plan showing how the recommendations of Chapter 3 and 4 meet the goals identified in Chapter 1, activities to be undertaken to meet those goals, and a first year budget that delineates the major cost items in the first year of the Strategic Communications Network Plan.

5.1 RECOMMENDATIONS

The ten recommendations presented in Chapters 3 and 4 are listed below:

- The State should implement an integrated digital backbone network to support all network services, including voice, data, video, and radio.

- The State should initiate a pilot test of different video configurations and systems to identify the most appropriate video system for the State.

- The State should implement a statewide Transparent Uniform Numbering Plan (TUNP) voice network that provides simplified user dialing procedures and greater switch routing functionality.

- The State should continue the operation of CMS's SNA network as is done now, and begin migrating non-SNA systems onto an X.25 backbone as soon as feasible.

- The State should encourage the implementation of international data network standards. Specifically, the State should initiate a pilot test between the OSI and SNA communities to test various applications such as electronic mail.

- The State should design Metropolitan Area Networks (MANs) for Springfield and Chicago to provide more economical local service in these major metropolitan areas.

- The State should lease transmission facilities wherever possible to encourage the development of digital facilities throughout the State of Illinois and to reduce the State's risk.

- The State should take responsibility for systems integration, but use the services of a system integration contractor to support the implementation of the various voice, data, video, and transmission facilities recommended above.

- The State should operate the integrated digital backbone network, voice switching equipment, data switching equipment, and video equipment. A centralized agency should manage the integrated digital backbone network and coordinate the management of voice, data, and video switching equipment. Updating routing tables must be centrally coordinated.

- The State should procure the transmission facilities, facility allocation control, TUNP voice network, X.25 data network, SNA data network, appropriate video equipment, and systems integration support. The transmission facilities, facility allocation control, and systems integration should be bundled into a single procurement. All other systems should be selectively bundled as options that any vendor can bid.

- The State should establish a permanent Steering Committee responsible for guiding the State's long term communications strategy.

Figure 5-1 shows how these ten recommendations support the goals described in Chapter 1. Costs and cost savings are also summarized in Figure 1.

A coordinated, timely action plan is needed to achieve the goals listed in Figure 5-1. Section 5.2 below describes the eight key activities that we feel the State should undertake to support the recommendations listed above.

Recommendations versus Goals

	Backbone Network	Video Pilot	TUNP	SNA/X.25	OSI Pilot	MAN	Leased Facilities	Systems Integration Support	Centralized Management	Bundled Procurement	Steering Comm
Expected Capital Costs	$413,500	$23,000	$100,000	N/A	$162,500	$224,000	N/A	N/A	N/A	N/A	$343,000
Expected Five-year Cost Savings	$62,000,000	N/A	$3,500,000	N/A	N/A	20-50%	N/A	N/A	N/A	N/A	N/A
Economies of Scale	√		√	√		√	√			√	
Competitive Bids	√		√	√		√	√	√		√	
System and Equipment Performance	√	√	√	√	√	√	√				
Maximize Network Effectiveness	√	√	√	√	√	√	√	√	√	√	√
Assure a Continual Response	√		√	√	√		√	√	√		√

Figure 5-1

5.2 TRANSITION PLAN

This section describes the actual tasks and the chronology of activities in the transition years that are needed to execute the activities associated with the identified goals. There are eight major "tracks," which are listed below:

1. Established a planning and coordination function

2. Optimize the current voice network

3. Implement a statewide backbone network

4. Design and implement a statewide long distance network with a transparent uniform numbering plan (TUNP)

5. Pilot test a statewide video network

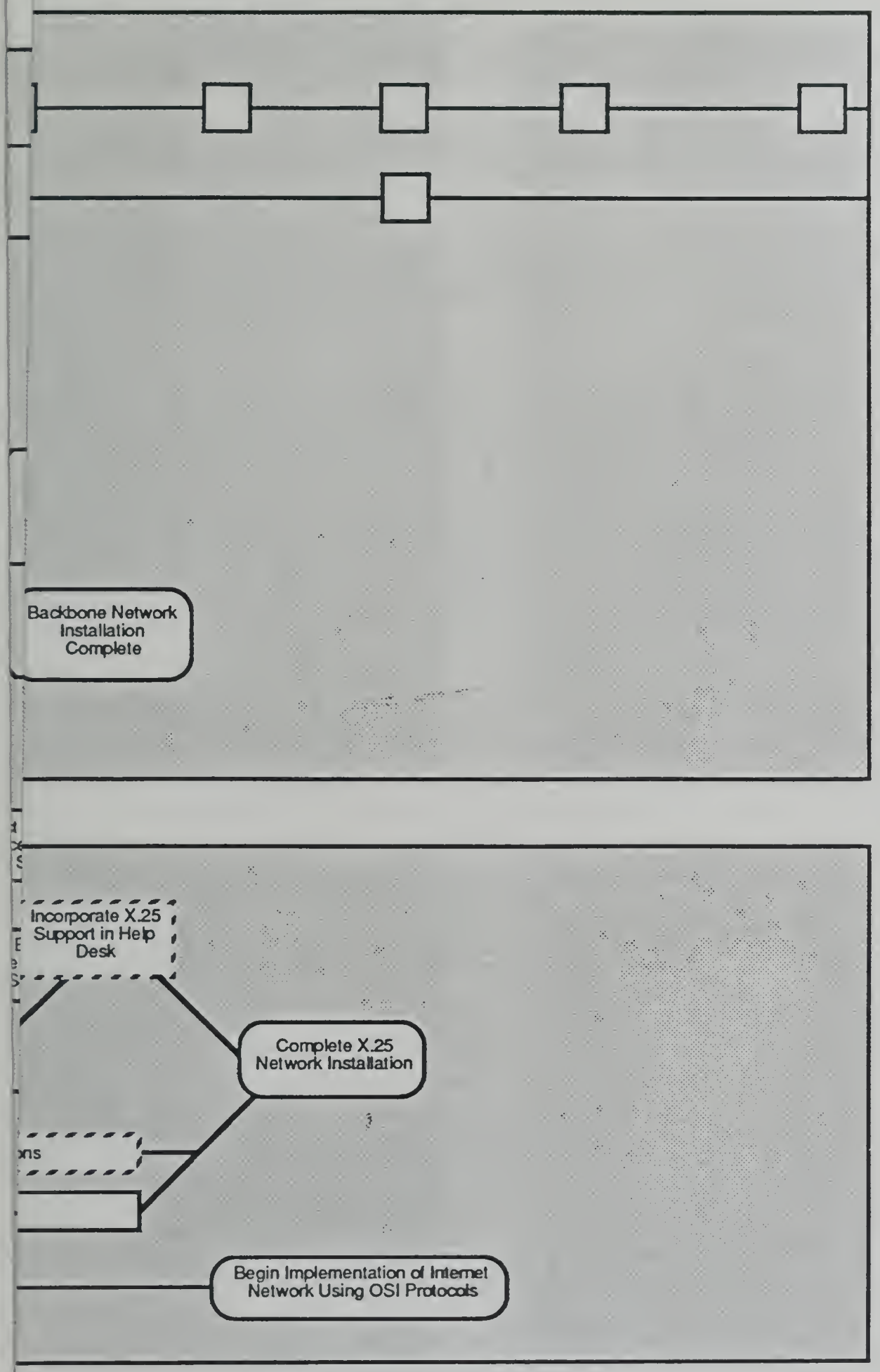
6. Design and implement metropolitan area networks

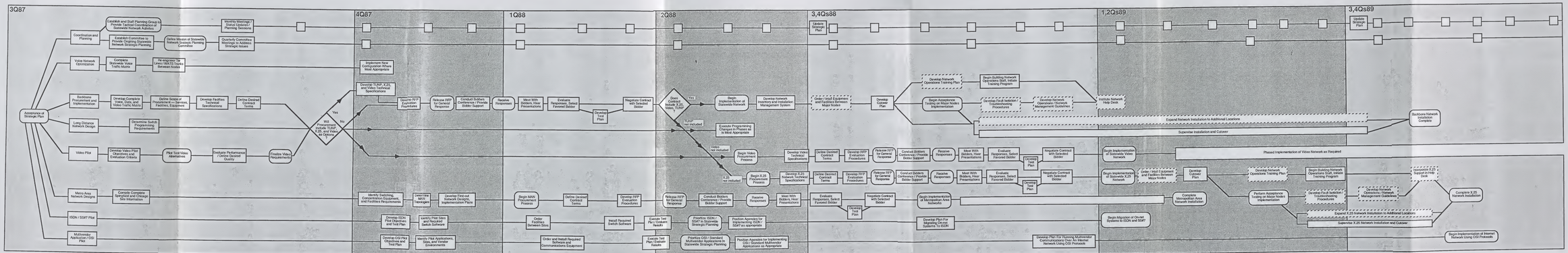
7. Pilot test ISDN and SS#7 capabilities on existing voice systems, and plan for the eventual migration to these standards

8. Pilot test multivendor, cross-system applications using OSI protocols, and plan for the eventual migration to these standards

Figure 5-2 illustrates the component activities associated with these eight tracks. It identifies activities starting in the third quarter of 1987 (3Q87), and runs through the third and fourth quarters of 1989 (3,4Qs89). In addition to these activities, the coordination and planning track activities continue through the remainder of the plan period, the second quarter of 1992. Milestones are indicated as rounded rectangles, and activities that are required, but which may become the responsibility of a selected vendor, are indicated as rectangles with striped borders.

Figure 5-2 describes an aggressive schedule. This schedule is designed to bring the greatest benefit to the State as quickly as possible. The State may find this schedule impossible to accommodate due to the large number of parallel activities. If this is the case, two of the tracks can be delayed without altering the cost reductions and many of the other benefits associated with this plan. The ISDN/SS #7 Pilot and the multivendor Applications/OSI Pilot can both be delayed until the second or even third year if necessary to help balance the workload during the transition period. These pilots should be based on the international implementation of the relevant standards at that time.


Backbone Network Installation Complete
Incorporate X.25 Support in Help Desk
Complete X.25 Network Installation
Begin Implementation of Internet Network Using OSI Protocols


3Q87
4Q87
1Q88
2Q88
3,4Qs88
1,2Qs89
3,4Qs89
Assistance of Strategic Plan
Coordination and Planning
Establish and Staff Planning Group to Develop Statewide Network Activities
Establish Committee to Provide Ongoing Statewide Network Strategic Planning
Define Mission of Statewide Network Strategic Planning Committee
Monthly Meetings / Quarterly Committee Planning Sessions
Quarterly Committee Meetings to Address Strategic Issues
Voice Network Optimization
Complete Voice Traffic Matrix
Re-engineer Tie Lines/WATS Mileage Between Nodes
Backbone Network Design and Implementation
Develop Complete Voice, Data, and Video Traffic Matrix
Define Scope of Requirements — Services, Facilities, Equipment
Develop Facilities Technical Specifications
Define Desired Contract Terms
Long Distance Network Design
Determine Switch Programming Requirements
Video Pilot
Develop Video Pilot Objectives and Evaluation Criteria
Pilot Test Video Attendances
Evaluate Performance / Cost / Quality
Finalize Video Requirements
Will Procurement Process for X.25, and Video as Options
Yes
No
Implement New Configuration Where Most Appropriate
Develop TUNP, X.25, and Video Technical Specifications
Develop RFP Evaluation Procedures
Release RFP for General Response
Conduct Bidders Conference / Provide Bidder Support
Receive Responses
Meet With Bidders, Hear Presentations
Evaluate Responses, Select Favored Bidder
Develop Test Plan
Negotiate Contract with Selected Bidder
Does Current Include X.25, Video, TUNP
Yes
TUNP not included
Begin Implementation of Statewide Network
Develop Network Inventory and Installation Management System
Execute Programming Changes to Switch Where Most Appropriate
Video Now included
Begin Video Procurement Process
X.25 not included
Begin X.25 Procurement Process
Develop X.25 Network Technical Specifications
Develop Video Technical Specifications
Define Desired Contract Terms
Develop RFP Evaluation Procedures
Release RFP for General Response
Conduct Bidders Conference / Provide Bidder Support
Receive Responses
Meet With Bidders, Hear Presentations
Evaluate Responses, Select Favored Bidder
Develop Test Plan
Negotiate Contract with Selected Bidder
Begin Implementation of Metropolitan Area Networks
Develop Plan For Connecting Systems To ISDN
Develop Plan For Running Multivendor Communications Over An Internet Network Using OSI Protocols
Update Strategic Plan
Develop Network Operations Training Plan
Begin Building Network Operations Staff, Initiate Training Program
Develop Network Operations / Network Management Guidelines
Develop Fault Isolation / Troubleshooting Procedures
Begin Acceptance Testing on Major Nodes Implementation
Institute Network Help Desk
Expand Network Installation to Additional Locations
Supervise Installation and Cutover
Backbone Network Installation Complete
Begin Implementation of Statewide Video Network
Phased Implementation of Video Network as Required
Begin Implementation of Statewide X.25 Network
Order / Install Equipment and Facilities Between Major Nodes
Develop Cutover Plan
Perform Acceptance Testing on Major Nodes Implementation
Expand X.25 Network Installation to Additional Locations
Supervise X.25 Network Installation and Cutover
Complete X.25 Network Installation
Begin Implementation of Internet Network Using OSI Protocols
Begin Migration of Circuit Systems to ISDN and SS#7
Complete Metropolitan Area Network Installation
Identify Switching Concentration Equipment, and Facilities Requirements
Determine MAN Topologies
Develop Field-out Network Decision Implementation Plans
Develop ISDN Pilot Objectives and Test Plan
Develop OSI Pilot Objectives and Test Plan
Identify Pilot Sites and Required Switch Software
Identify Pilot Applications, and Pilot Test Environments
Begin MAN Procurement Process
Define Desired Contract Terms
Develop RFP Evaluation Procedures
Release RFP for General Response
Conduct Bidders Conference / Provide Bidder Support
Receive Responses
Meet With Bidders, Hear Presentations
Order Facilities Between Sites
Install Required Switch Software
Exercise Test Plan, Evaluate Results
Prioritize ISDN / SS#7 in Statewide Strategic Planning
Position Agencies for Implementing ISDN / SS#7 as Appropriate
Order and Install Required Communications Equipment
Exercise Test Plan, Evaluate Results
Prioritize OSI / Standard-Based Applications in Statewide Strategic Planning
Position Agencies for Implementing OSI / Standard-Based Applications as Appropriate

The sections that follow discuss the activities associated with the eight tracks.

5.2.1 Coordination and Planning

The coordination and planning activities hinge upon the establishment of a Steering Committee and a Coordinated Planning Group. The Steering Committee will have responsibility for determining what services will be centrally provided to the State's agencies. The services the State will be able to offer will change and grow in complexity as well as quantity as the State installs more advanced, more cost-effective networking resources. The Steering Committee will have the responsibility for guiding the State to strategically sound commitments. Quarterly meetings of the Steering Committee should be held to assess the State's strategic position.

The Coordinated Planning Group will have the responsibility for daily oversight of all network-related activities. The planning group should also be responsible for making yearly updates to the strategic plan for presentation to the Steering Committee.

5.2.2 Voice Network Optimization

The State can realize immediate cost reductions by optimizing the current voice network trunking and WATS arrangements. The first step in the optimization process requires the State to develop a complete statewide voice traffic matrix. Once completed, this traffic matrix can be used to easily re-engineer the State's voice facilities. The State should proceed with implementing more efficient voice configurations only when the payback occurs before the configuration is again modified by a statewide facilities procurement and installation.

The State may also benefit from verifying its invoices, to check if a billed service is actually being provided. In the process of changing the network configuration in such a large environment, certain unneeded services may not have been terminated, or services may have been ordered for a purpose that was later abandoned. Billing inconsistencies in networks of this size are common, and frequently result in significant cost reductions when rectified.

5.2.3 Statewide Backbone Implementation

The procurement and implementation of a statewide backbone network is a track of activities which will continue through 1989. This track includes three major phases: RFP development, vendor selection, and installation.

The first phase, RFP development, is dependent upon the video pilot phase of the video network implementation track, described in Section 5.2.5. It must be decided in this phase whether or not to bundle the long-distance network procurement, the video network procurement, and an X.25 network procurement.

The second phase involves the actual release of the RFP and the evaluation of the responses: it will vary only in the types of options that are included in each proposal. If X.25, video, and long-distance networks are all included in the RFP, the responses will be proportionately more difficult to evaluate.

The third phase will vary depending on whether any X.25, video, or long-distance network options included in the RFP are acceptable. If the State does not accept these options as part of a successful bidder's proposal, then the State will have to pursue the implementation of these networks separately.

5.2.3.1 First Phase

The activities required in the first phase are listed as follows: develop a complete traffic matrix for all types of traffic to be carried on the network; define the scope of the procurement in terms of equipment, facilities, and services; develop the technical specifications for the facilities portion of the RFP and any other systems to be included as options; define the desired contract terms; and develop the RFP evaluation procedures. All of these activities result in the development of sections of the RFP. By completing these activities, the RFP will essentially be complete and will require only minor additional development work.

The completion of a comprehensive traffic matrix will be included in the RFP as part of the technical specifications. The "definition of scope" activity will define for prospective bidders the services, equipment, and transmission facilities they must provide to the State. The "technical specifications" activity will define the capabilities required of proposed equipment and transmission facilities and will specify what functions the bidder must supply for each requested service. The "contract terms" activity will define what options for procurement the State is willing to accept, and what guarantees the State will require of a successful bidder to limit its liability. The "RFP evaluation criteria" activity will identify for prospective bidders what the evaluation criteria will be, how the different requirements will be weighted, and what equipment, transmission facilities, and services will be optional.

5.2.3.2 Second Phase

The activities required in the second phase ensure that the proposals the State receives are responsive and clear, and that the State negotiates a contract that is agreeable to the bidder but which also provides for the State's requirements. This phase includes the actual release of the RFP, the conducting of a bidders conference and associated bidder support during the response period, the receipt of responses, meetings with bidders to receive additional information about each proposal, the evaluation of the proposals, the selection of a bidder, the development of a test plan, and final contract negotiations.

The bidders conference will provide an opportunity for interested vendors to ask questions about the RFP and request clarification of any sections or clauses. It will also afford the State the opportunity to clarify its requirements, evaluation criteria, technical specifications, and any other component of the RFP. The State must also be prepared to support interested vendors throughout the proposal development period, answering questions, clarifying requirements, and responding to any other legitimate vendor concerns. Strong support during this process will be of invaluable to the vendors, and consequently will result in the State's receiving better, more responsive proposals.

The State should also give bidders the opportunity to present their proposals to the proposal evaluators. This will give the evaluators an opportunity to more clearly understand the details of each proposal, as well as each bidder's technical competence and ability to provide the proposed services. This greater understanding will be invaluable in selecting the vendor whose proposal, with any modifications made in the negotiations process, will most effectively meet the needs of the State.

After hearing all vendor presentations, the State must evaluate and rank the proposals and make a selection and then begin to negotiate with the vendor which submitted the most attractive response. Concurrent with contract negotiations, the State must develop the test plan it will use to determine the acceptability of the proposed equipment, services, and facilities. This test plan, and defined avenues of redress should the equipment, services, or facilities prove unsatisfactory, should be incorporated into the contract between the State and the vendor. It is necessary, therefore, to expedite the development of the test plan. The test plan will vary according to the basic proposal and the selected options the State chooses to accept.

5.2.3.3 Third Phase

Assuming an acceptable contract can be negotiated, the State must then proceed on to the third phase of the backbone implementation. Based on the decisions made in proposal evaluation an contract negotiations, the State may have elected to procure and X.25 network, a long distance network, and/or a video network, all under the same contract. If all three of these options are included in the contract, the State can then focus on the installation process. If one or more of these options are not included, the State must make provisions for procuring and implementing these networks separately, while concurrently supervising the installation of the backbone facilities.

In the installation phase, the State must have available to it an inventory and installation management system. This system could be developed by the State, or be provided by the selected vendor. The State should ensure that it can track expenditures for inventory, as well as identify the location and configuration of each component. Regardless of whether this activity is provided by the vendor or by the State, the State should be able to obtain reports that contain this information.

Once a management system is available, the State can begin actual installation. We recommend that the State install a subset of the new configuration first, and perform acceptance testing on this subset before continuing with the installation. Figure 5-3 shows the configuration we recommend for initial installation and acceptance testing, and Figures 5-4 and 5-5 identify the recommended ensuing phases. The required equipment, facilities, and services between Springfield and Chicago, Springfield and Champaign, and Champaign and Chicago should be installed, thoroughly tested, and accepted before any further installation is performed.

In conjunction with this first level installation, the State should develop a cutover plan which will define the steps required to bring the new configuration on-line as it is tested and accepted. This plan should include provisions for fall back to the previous configuration in case cutover is unsuccessful.

To manage the network effectively, the State must ensure that it has sufficient expertise available in its permanent and contracted staff. The development of a network operations training plan should begin as soon as possible after the cutover plan is completed. This plan may be developed by the vendor as part of the overall procurement, or the State may have this responsibility. Once the training plan is completed, the State should begin to build its network management expertise by adding new staff where necessary and training both new and existing staff in the network operations training program. As an extension of this staffing, the State should institute a centralized help desk for handling user-identified problems. This help desk

Facilities Backbone - Initial Installation

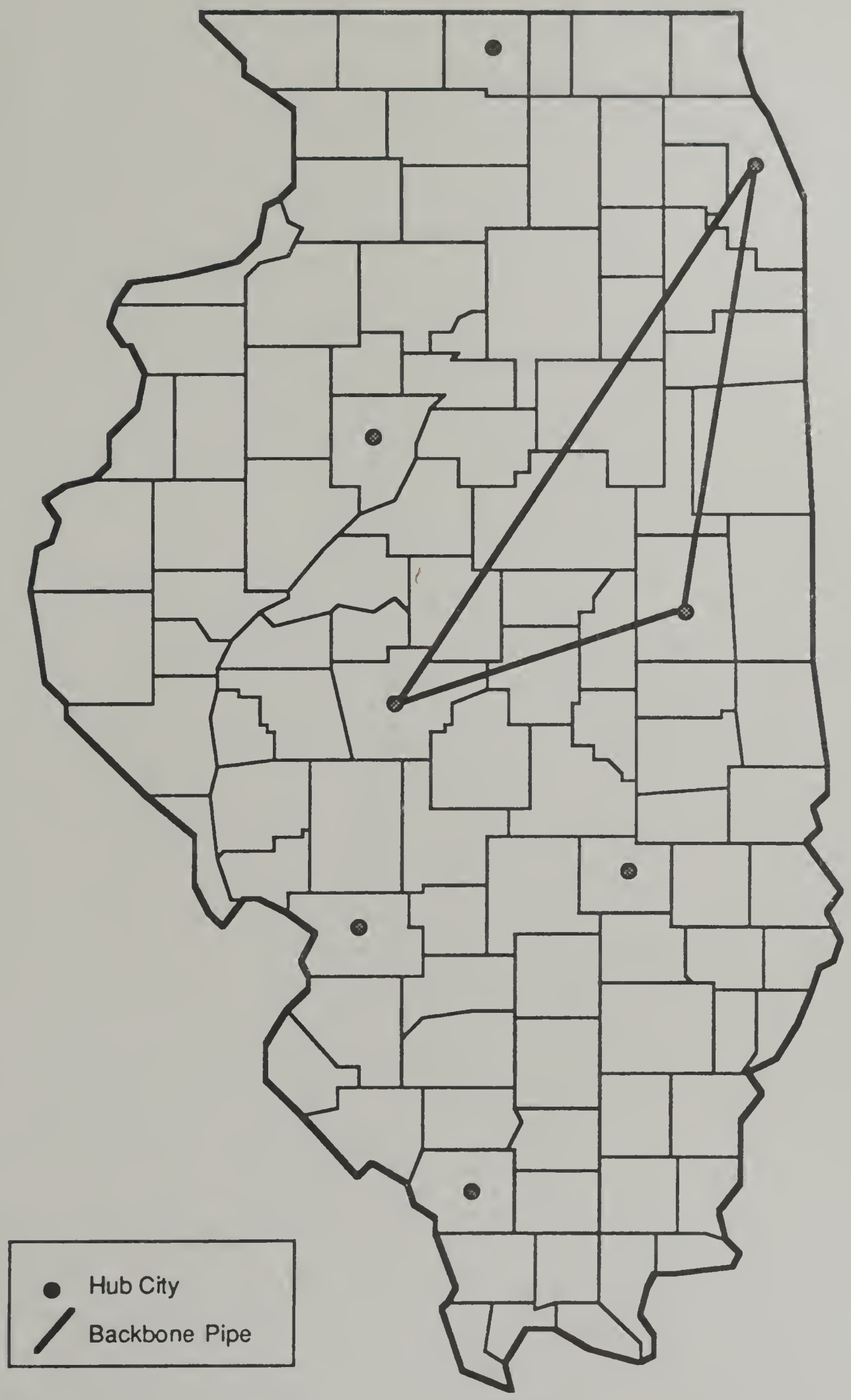


Figure 5-3

Network Strategies, Inc.

Facilities Backbone - Second Phase

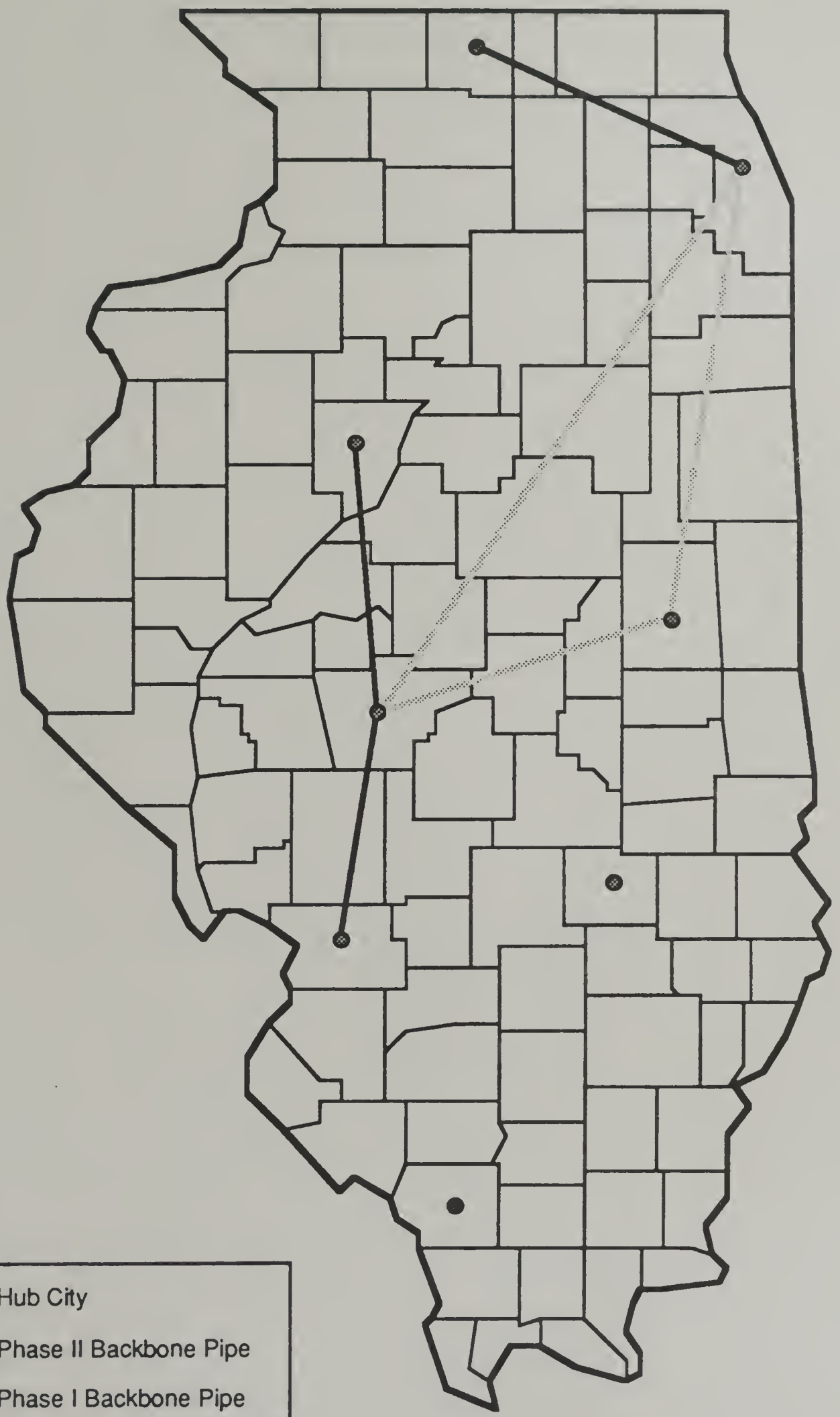


Figure 5-4

Network Strategies, Inc.

Facilities Backbone - Third Phase

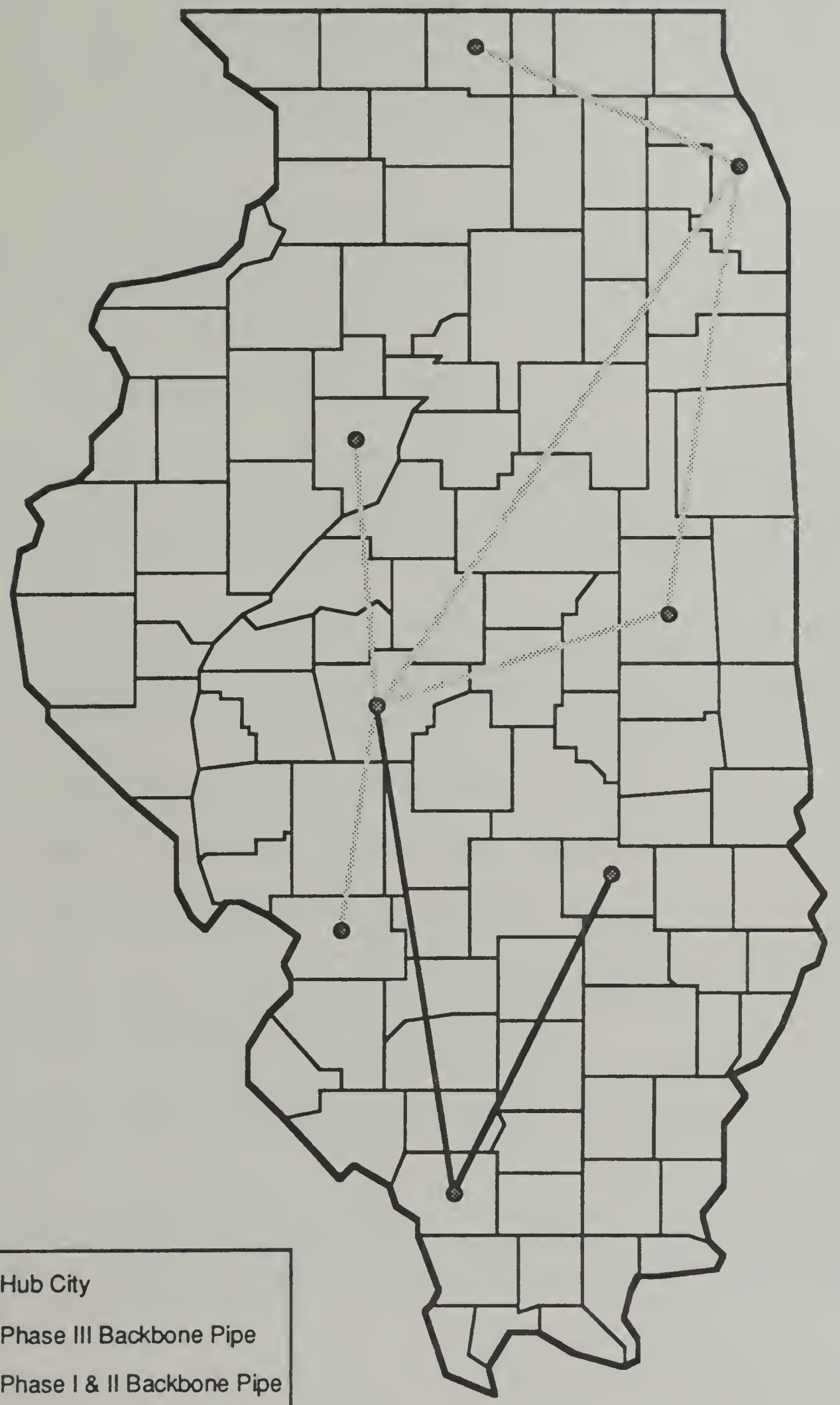


Figure 5-5

Network Strategies, Inc.

long-distance network. A detailed design of this network involves mainly a determination of the required switch programming, some retrunking of inter-switch connections, and a plan for supporting the network. We recommend that the State include this network in its backbone procurement. If this is to be the case, the switch requirements must be determined quickly so that technical specifications and contract terms relating to the network can be included in the RFP.

If the long-distance network is not obtained as part of the backbone procurement, then implementation of the long-distance network can begin as soon as the design is completed. It may, however, be prudent to wait until the backbone has been procured and the backbone facilities between switching sites are well defined before beginning the actual installation.

5.2.5 Pilot Test Video Network Services

The State should begin to explore immediately the available technologies available for video networking. Although the State's requirements for video are just emerging, including the transmission facilities to support video will enable the State to obtain a more cost-effective video network than would otherwise be possible.

The State must have some understanding of the variety of options available with today's video technologies. The quickest and most effective way to demonstrate different video capabilities is to conduct a pilot test of the various options. The State must develop criteria for the video pilot, such as those listed below:

- Determinate acceptable video quality
- Determinate acceptable room/studio requirements
- Determinate acceptable costs per video location
- Define required management and control features
- Define acceptable delay in video call setup
- Determine acceptable network operator involvement in video call setups

The criteria of the video pilot should direct the State toward defining what type of video service is acceptable. The pilot will then allow the State to finalize its video requirements in sufficient detail for facilities requirements to be included in the backbone procurement.

If the backbone procurement does not include all of the State's video requirements, then the State will have to procure its video network separately, following essentially the same procedures as in procuring the backbone network. These procedures, described in Section 5.2.3 above, include the development of technical specifications, contract terms, and evaluation procedures, as well as providing bidder support, evaluating responses, and negotiating a satisfactory contract. The actual installation of the video network can occur as specific requirements dictate.

5.2.6 Metropolitan Area Network Designs

Primarily focused on data communications, the metropolitan area network design track has the potential to generate substantial savings through a comprehensive redesign of the State's network configuration in a metropolitan area. Through the use of bypass technologies, State-owned rights-of-way, and more cost-effective service offerings, the State can develop metropolitan area networks which can produce dramatic cost savings while remaining flexible and expandable enough to support the State's current and future metropolitan area requirements. Springfield and Chicago are the obvious choices for the initial activity; other cities may also be worth investigating, depending on the size of their communications resources requirements.

The activities that must be performed in pursuing new metropolitan networks include a procurement process essentially identical to that detailed in Section 5.2.3. First, however, the State must thoroughly document all sites that are being considered in the metro areas. Requirements must be compiled, including network response times, availability and security requirements, and cost allocation requirements. Site information must also be gathered to determine where space exists for the placement of concentrating equipment.

The State must then determine the most workable topologies for each city, taking into consideration the distribution of sites, the space available in each, the availability of microwave and optical fiber rights-of-way, etc. From these topologies, an initial network design must be developed for use in defining technical specifications and determining estimated cost savings. The State should also develop an implementation plan for each city.

Upon the completion of these activities, the State can then begin the procurement and installation process. Design and procurement of the metropolitan area networks can best be performed with a knowledge of the locations and facilitiesthat are available as part of the statewide backbone network. Therefore, we recommend that the State delay the metropolitan area network redesigns and procurements until the backbone network configuration is finalized.

5.2.7 ISDN / SS#7 Pilot

The State should investigate Integrated Services Digital Networks (ISDN) and Electronic Signaling System Number 7 (SS#7) as part of its strategic effort to take advantage of new technologies. We have identified the activities required to explore ISDN in a separate track which begins in 4Q87 and extends through 1988.

ISDN and SS#7 offer the potential for a wide variety of new services, both for the end-user and for enhanced network management and control. These services include:

- Integrated voice-data switching
- Improved call setup efficiency
- Reduced call setup delay
- Increased call setup and restriction options
- Greater compatibility between terminal devices and Switching systems
- Reduced number of configuration databases
- Improved diagnostics and load management
- Broadened network-wide features

To take advantage of these capabilities, the State must design a pilot and test plan which will identify the strengths and limits of ISDN and SS#7 in each of these areas.

The State must select test sites which can support experimental services without disrupting required operations. These test sites must also be in locations at which ISDN trunks are available, and where site personnel are capable of executing the test plan and documenting the results.

It may be necessary to submit a special request to each site's service vendor / local exchange carrier for the desired ISDN facilities if these facilities are not generally available by the time the State is ready to begin its pilot. For this reason, a substantial lead time between the ordering of facilities and their actual availability must be expected. This delay is incorporated into the ISDN track shown in Figure 5-2.

Once the pilot is completed and the results are evaluated, the State must then examine how important the enhanced services available with ISDN and SS#7 are, and assign a priority to the deployment of ISDN statewide. Once a priority is defined, the State can develop a plan for migrating from the current environment to one which uses ISDN and SS#7. We expect that the benefits of these technologies will be sufficient for the State to begin migration in early 1989.

5.2.8 Multivendor Applications / OSI Pilot

The State should investigate the International Standards Organization (ISO) Open System Interconnection (OSI) protocols and IBM's SNA protocol to support multivendor, cross-system applications as part of its strategic effort to remain positioned to take advantage of new technologies. We have identified the activities required to explore OSI/SNA connectivity in a separate track which begins in 4Q87 and extends through 1989. This track is primarily designed to enhance the State's data communications. The actual schedule of this track will depend on the finalization of these standards and their appearance in products.

OSI protocols will enable the State to support a wide variety of new services. Communications among systems from multiple vendors will be standardized, thus expediting implementation of advanced distributed applications which require interaction between multiple sources. Currently, such applications are difficult to develop, and vary drastically depending upon the vendor and system type involved. The OSI protocols will eliminate these variances.

The State must design a pilot test plan that explores the strengths and limitations of OSI/SNA protocol connectivity. The pilot should include the following aspects:

- Test of multivendor applications such as file transfer and electronic messaging
- Test of third-party gateways to accomplish multivendor communications
- Test of OSI/SNA protocols to support applications requiring multivendor communications
- Test of OSI/SNA gateways and an "OSI internet" to support communications between proprietary network architectures

To adequately test these components, the State will have to identify sites with equipment that can support OSI/SNA protocols and software; vendors are in various stages of delivering and supporting OSI-compatible software. The State will have to add software modules and stand-alone equipment to its current configuration.

Test sites must also be capable of supporting experimental services without disrupting required operations, and must have personnel capable of executing the test plan and documenting the results.

Once the pilot is completed and the results are evaluated, the State must then examine how important the enhanced services available with OSI protocols are, and assign a priority to the deployment of an OSI internetwork statewide. Once a priority is defined, the State can develop a plan for migrating from the current environment to one which uses OSI protocols for intersystem and internetwork communications. We expect that the benefits of these technologies will be sufficient for the State to begin migration in early 1989.

5.3 FIRST YEAR BUDGET

The activities identified in the eight tracks described above are activities that the State does not routinely perform. The cost of conducting these activities is therefore not included in the State's current communications budget. Activities shown in Figure 5-2 which occur in 3Q87, 4Q87, 1Q88, and 2Q88 represent those activities which must be performed "in the first year". Figure 5-6 identifies the estimated costs of performing these activities.

Track	Quarter	Activity	Staff	Calendar Time	%Staff Effort	Staff Months	Cost/Staff Month	Staff Cost	Equipment Cost	Facilities Cost	Software Cost	Service Cost	Total Cost
Planning and Coordination													
	3Q87												
		Establish Planning Group	2	1	0.5	1	6500	6500	0	0	0	0	$6,500
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Establish Steering Committee	2	1	0.5	1	6500	6500	0	0	0	0	$6,500
		Define Mission of Steering Committee	15	2	0.25	7.5	6500	48750	0	0	0	0	$48,750
		Quarterly Steering Committee Meeting	15	0.25	0.25	0.938	6500	6094	0	0	0	0	$6,094
		Quarter Total				11.06	6500	71906	0	0	0	0	$71,906
	4Q87												
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Quarterly Steering Committee Meeting	20	0.25	0.25	1.25	6500	8125	0	0	0	0	$8,125
		Quarter Total				2.188	6500	14219	0	0	0	0	$14,219
	1Q88												
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Quarterly Steering Committee Meeting	20	0.25	0.25	1.25	6500	8125	0	0	0	0	$8,125
		Quarter Total				2.188	6500	14219	0	0	0	0	$14,219
	2Q88												
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Monthly Planning Session	5	0.25	0.25	0.313	6500	2031	0	0	0	0	$2,031
		Quarterly Steering Committee Meeting	20	0.25	0.25	1.25	6500	8125	0	0	0	0	$8,125
		Quarter Total				2.188	6500	14219	0	0	0	0	$14,219
Track Total						17.63	6500	114563	0	0	0	0	$114,563
Voice Network Optimization													
	3Q87												
		Complete Statewide Traffic Matrix	4	2	1	8	6500	52000	0	0	0	0	$52,000
		Re-engineer Tie Lines / WATS Trunks	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Quarter Total				10	6500	65000	0	0	0	0	$65,000
	4Q87												
		Implement New Configuration	2	3	0.5	3	6500	19500	0	0	0	0	$19,500
		Quarter Total				3	6500	19500	0	0	0	0	$19,500
	1Q88					0	6500	0	0	0	0	0	$0
	2Q88					0	6500	0	0	0	0	0	$0
Track Total						13	6500	84500	0	0	0	0	$84,500
Backbone Procurement and Implementation													
	3Q87												
		Develop Complete Voice, Data, and Video Traffic Matrix	2	2	1	4	6500	26000	0	0	0	0	$26,000
		Define Scope of Procurement	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Develop Facilities Technical Specifications	4	1.5	1	6	6500	39000	0	0	0	0	$39,000
		Define Desired Contract Terms	4	2	1	8	6500	52000	0	0	0	0	$52,000
		Quarter Total				20	6500	130000	0	0	0	0	$130,000
	4Q87												
		Develop TUNP, X.25, and Video Technical Specifications	4	3	1	12	6500	78000	0	0	0	0	$78,000
		Develop RFP Evaluation Procedures	4	2	1	8	6500	52000	0	0	0	0	$52,000
		Finalize RFP	6	0.5	1	3	6500	19500	0	0	0	0	$19,500
		Conduct Bidders Conference	2	0.25	1	0.5	6500	3250	0	0	0	0	$3,250
		Quarter Total				23.5	6500	152750	0	0	0	0	$152,750
	1Q88												
		Meet with Bidders, Hear Presentations	2	0.5	1	1	6500	6500	0	0	0	0	$6,500
		Evaluate Responses, Select Bidder	5	1.5	0.75	5.625	6500	36563	0	0	0	0	$36,563
		Develop Test Plan	2	3	0.5	3	6500	19500	0	0	0	0	$19,500
		Negotiate Contract with Selected Bidder	3	1	0.5	1.5	6500	9750	0	0	0	0	$9,750
		Quarter Total				11.13	6500	72313	0	0	0	0	$72,313
	2Q88												
		Develop Network Inventory and Installation Management System	3	3	1	9	6500	58500	0	0	0	0	$58,500
		Quarter Total				9	6500	58500	0	0	0	0	$58,500
Track Total						63.63	6500	413563	0	0	0	0	$413,563
Long Distance Network and TUNP													
	3Q87												
		Determine Switch Programming Requirements	1	2	1	2	6500	13000	0	0	0	0	$13,000
		Develop Plan for Ongoing Support	1	1	1	1	6500	6500	0	0	0	0	$6,500
		Quarter Total				3	6500	19500	0	0	0	0	$19,500
	4Q87					0	6500	0	0	0	0	0	$0
	1Q88					0	6500	0	0	0	0	0	$0
	2Q88					0	6500	0	0	0	0	0	$0
Track Total						3	6500	19500	0	0	0	0	$19,500

Figure 5-6

Track	Quarter	Activity	Staff	Calendar Time	%Staff Effort	Staff Months	Cost/Staff Month	Staff Cost	Equipment Cost	Facilities Cost	Software Cost	Service Cost	Total Cost
Video Network Pilot and Implementation													
	3Q87												
		Develop Video Pilot Objectives / Evaluation Criteria	2	1	0.5	1	6500	6500	0	0	0	0	$6,500
		Pilot Test Video Alternatives	2	1	0.5	1	6500	8500	0	0	0	0	$6,500
		Evaluate Performance / Define Desired Quality	2	0.5	1	1	6500	6500	0	0	0	0	$6,500
		Finalize Video Requirements	2	0.5	0.5	0.5	6500	3250	0	0	0	0	$3,250
		Quarter Total				3.5	6500	22750	0	0	0	0	$22,750
	4Q87					0	8500	0	0	0	0	0	$0
	1Q88					0	6500	0	0	0	0	0	$0
	2Q88					0	6500	0	0	0	0	0	$0
Track Total						3.5	6500	22750	0	0	0	0	$22,750
Metropolitan Area Network Implementation													$0
	3Q87												
		Compile Complete Springfield and Chicago Site Information	2	2	1	4	6500	26000	0	0	0	0	$26,000
		Quarter Total				4	6500	26000	0	0	0	0	$26,000
	4Q87												
		Identify Switching, Equipment, and Facilities Requirements	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Determine MAN Topologies	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Quarter Total				4	6500	26000	0	0	0	0	$26,000
	1Q88												
		Develop First-cut Network Designs, Implementation Plans	2	2	1	4	6500	26000	0	0	0	0	$26,000
		Define Desired Contract Terms	4	2	1	8	6500	52000	0	0	0	0	$52,000
		Develop RFP Evaluation Procedures	4	2	1	8	6500	52000	0	0	0	0	$52,000
		Quarter Total				20	6500	130000	0	0	0	0	$130,000
	2Q88												
		Finalize RFP	10	0.5	1	5	6500	32500	0	0	0	0	$32,500
		Conduct Bidders Conference	2	0.25	1	0.5	6500	3250	0	0	0	0	$3,250
		Meet with Bidders, Hear Presentations	2	0.5	1	1	6500	6500	0	0	0	0	$6,500
		Quarter Total				6.5	6500	42250	0	0	0	0	$42,250
							6500						
Track Total						34.5	6500	224250	0	0	0	0	$224,250
ISDN / SS#7 Pilot													
	3Q87					0	6500	0	0	0	0	0	$0
	4Q87					0	6500	0	0	0	0	0	$0
		Develop ISDN Pilot Objectives and Test Plan	2	2	1	4	6500	26000	0	0	0	0	$26,000
		Identify Pilot Sites and Required Switch Software	1	3	1	3	6500	19500	0	0	0	0	$19,500
		Quarter Total				7	6500	45500	0	0	0	0	$45,500
	1Q88												
		Order Facilities Between Sites	1	1	0.5	0.5	6500	3250	3600	69840	0	0	$76,690
		Install Required Switch Software	3	2	1	6	6500	39000	0	0	36000	0	$75,000
		Quarter Total				6.5	6500	42250	3600	69840	36000	0	$151,690
	2Q88												
		Execute Test Plan / Evaluate Results	3	3	1	9	6500	58500	0	0	0	0	$58,500
		Prioritize ISDN in Statewide Strategic Planning	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Position Agencies for Implementing ISDN as Appropriate	1	3	1	3	6500	19500	0	0	0	0	$19,500
		Quarter Total				14	6500	91000	0	0	0	0	$91,000
Track Total						27.5	6500	178750	3600	69840	36000	0	$288,190
Multivendor Application / OSI Pilot													
	3Q87					0	6500	0	0	0	0	0	$0
	4Q87					0	6500	0	0	0	0	0	$0
		Develop OSI Pilot Objectives and Test Plan	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Identify Pilot Applications, Sites and Vendor Environments	1	3	1	3	6500	19500	0	0	0	0	$19,500
		Quarter Total				5	6500	32500	0	0	0	0	$32,500
	1Q88												
		Order and Install Required Software and Equipment	3	2	1	6	6500	39000	3240	7200	18000	0	$67,440
		Quarter Total				6	6500	39000	3240	7200	18000	0	$67,440
	2Q88												
		Execute Test Plan / Evaluate Results	3	3	1	9	6500	58500	0	0	0	0	$58,500
		Prioritize OSI in Statewide Strategic Planning	2	1	1	2	6500	13000	0	0	0	0	$13,000
		Position Agencies for Implementing OSI as Appropriate	1	3	1	3	6500	19500	0	0	0	0	$19,500
		Quarter Total				14	6500	91000	0	0	0	0	$91,000
Track Total						25	6500	162500	0	0	0	0	$162,500
Total Budget By Quarters													
	3Q87					51.56		335156	0	0	0	0	$335,156
	4Q87					44.69		290469	0	0	0	0	$290,469
	1Q88					45.81		297781	6840	77040	54000	0	$435,661
	2Q88					45.69		296969	0	0	0	0	$296,969
First Year Budget (7/87 — 7/88)						187.8		1220375	6840	77040	54000	0	$1,358,255

Figure 5-6 (cont.)

As Figure 5-6 indicates, the estimated cost for performing all first-year activities totals almost $1,360,000. This cost is primarily composed of staff cost. However, approximately $138,000 is included for equipment, facilities, and software necessary to perform the recommended pilot activities.

The total cost of pursuing each track is provided in Figure 5-6, as is the cost per quarter. Of the eight tracks, the most resource intensive task is the Backbone Procurement and Installation track, requiring approximately $413,000 over the first year. The greatest expenditure occurs in the first quarter of 1988, during which approximately $435,000 will be required.

APPENDIX A

INTERVIEW SUMMARIES

Appendix A - Interview Summaries

This appendix contains summaries of interviews that were conducted with 21 major agencies of the Illinois State Government. The summaries are in alphabetical order by agency.

Personal interviews were conducted with the following agencies:

- Attorney General's Office
- CMS/Applications Development
- CMS/BICS/CSD T1 Network Unit
- CMS/CSD Radio Section
- CMS/Office Automation (WANGNET)
- Department of Children and Family Services
- Department of Commerce and Community Affairs/Data
- Department of Corrections/Data Processing
- Department of Corrections/Radio
- Department of Employment Security
- Department of Mental Health
- Department of Public Aid
- Department of Public Health
- Department of Transportation
- Illinois State Board of Education
- Illinois State Lottery
- Illinois State Police/Data Processing
- Illinois State Police/Radio Systems
- Secretary of State/Data Processing
- Secretary of State/Department of Police
- University of Illinois Urbana Champaign

In addition, follow-up telephone interview calls were made to the following people regarding future video applications:

- Norm Peterson, Governor's Commission for Technology Development
- Steve Sester, Illinois Institute for Technology
- Robert Wallhaus, Deputy Director, Board of Higher Education
- Don Mullaly, Illinois Public Radio Council
- Bill Glaeser, Manager, WIL-TV Channel 12

The interview agenda contained discussions on the following topics:

- Agency Functions and Missions
- Significant Existing Communications Requirements
- Networks that Satisfy these Communications Requirements
- Future Changes to Existing Networks
- Significant New Communications Requirements
- Communications and Interactions with Other Agencies

The written interview summary format follows a similar structure. The summary header contains the agency, the person(s) interviewed, the type of interview -- either personal or telephone, -- and the interview date.

Note that the telephone interview summaries do not follow the same format as the personal interviews because the telephone interviews were directed primarily to potential video applications and requirements.

AGENCY INTERVIEW RESULTS

Agency Interviewed:	**Office of Attorney General**
Person(s) Interviewed:	**Tim Havey**
Type of Interview:	**Personal**
Date of Interview:	**March 10, 1987**

Agency Functions and Missions

The Attorney General (AG) of Illinois is an independently elected official.

The Office of Attorney General represents state agencies in state and federal courts. The Opinion Division interprets statutes for Illinois officials and county state's attorneys. The General Law Division is responsible for a wide range of legal and administrative proceedings. Attorneys in the Revenue Division ensure that monies owed the state are collected.

Significant Existing Communications Requirements

Voice

The Attorney General offices in Springfield share the CMS Centrex service. Each attorney has a five-line set. There are approximately 20 speakerphones in various Attorney General offices and conference rooms. The AG office in Chicago is located on the SOIC/GTD PBX system and uses existing trunks, WATS and tie lines for calling.

Data

The Attorney General offices in Springfield and Chicago each have a Hewlett-Packard (HP) 3000 computer, each with 110 terminals connected. There are 19 satellite offices with PC's. There are nine satellite PC's linked to the Chicago HP 3000 and two PC's downstate linked to Springfield.

The satellite offices are connected to Chicago and Springfield via dedicated circuits into Micom stat mux machines. In Springfield there are 30 HP PC's which are IBM compatible. The HP system is equipped with HP desk manager for E-Mail. The AG now exchanges payroll tapes with the Comptroller's office.

The Office of the Attorney General currently uses LEXIS on dialogue. Usage is very heavy and it will continue to grow.

Future Changes to Existing Networks

The Springfield AG office will have major refurbishing performed in late 1987 and they are planning to rewire all offices and may add a digital PBX to obtain voice/data connectivity. The AG office also plans to install a high-speed LAN.

The AG's office plans to migrate it s Hewlett-Packard system to a SPECTRUM System. Also, there are plans to interconnect the HP desk manager with WANGNET E-Mail systems in the near future.

There was an indication that the attorneys could use a video conferencing facility, if available, in the Springfield and Chicago office locations.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Central Management Services/Applications Development
Person(s) Interviewed: John Henry, Dale Krehbeil, Kenneth Skoda
Type of Interview: Personal
Date of Interview: February 27, 1987

Agency Functions and Missions

Central Management Services/Applications Development provides software development and operations management support to government agencies under the Governor which require central computer data processing services. The applications support services provided include:

- payroll systems
- personnel systems
- procurement systems
- insurance programs
- inventory control system

Significant Existing Communications Requirements

Voice

All voice requirements at this location are provided by the CMS Centrex system.

Data

This group uses the existing central computer center system and works with the CMS Software Management Group in connection with central computer files, applications, expansion, and new development.

Networks that Satisfy these Communications Requirements

Central Management Services/Applications Development currently uses existing dial-up and leased line facilities provided for basic systems by CMS.

Future Changes to Existing Networks

Because this group is responsible for modifying existing applications to meet the changing needs of various agencies, the following areas were discussed regarding current requests from agencies for changes or new developments.

CMS has a major project identified to centralize all fragmented human resourcesystems used by a wide array of agencies and departments. This will require an increase in connection time between agency systems such as CMS and Comptrollers. There is pending legislation requiring a system application program to audit and monitor all EFT transactions of banks and trust companies in the state. There is a need to centralize all procurement automation systems, including those for state universities.

Significant New Communications Requirements

The state has a very large fleet of cars and other vehicles which are controlled and maintained by CMS. A new requirement has been identified for the 1988 fiscal year to develop a central file to identify all vehicles, maintenance repair records and schedules, and auto parts inventories at each garage statewide.

There is a future requirement to consolidate all CMS and BICS operations and communications equipment inventory into a central configuration office building and warehouse to be located in Springfield.

AGENCY INTERVIEW RESULTS

Agency Interviewed: CMS/BICS/CSD T1 Networs Unit
Person(s) Interviewed: Jean Stone, John Burge
Type of Interview: Personal
Date of Interview: March 9, 1987

Agency Functions and Missions

The CMS T1 network unit's responsibility is to review existing and future leased line requirements for potential consolidation of circuits into T1 type services to reduce costs for communications facilities.

Significant Existing Communications Requirements

Voice

The T1 Network Unit voice requirements consist of dial Centrex services. This unit is also reviewing large voice tie-line requirements between Centrex user locations for inclusion in a T1 "pipeline" shared facility. There are currently 90 voice and 40 data circuits in a T1 network link between Springfield and Chicago. There are 80 data circuits awaiting cutover into the T1 network. This group will have 250 total circuits in T1 networks when the 80 data circuits are completed.

Networks that Satisfy these Communications Requirements

The T1 network facilities currently being installed consist of diversely routed fiber provided by U.S. Sprint. Some previously installed T1 channels provided by AT&T use regular leased line cable. The T1 network currently saves the state $320 per month per tie line over the regular AT&T leased line rate between Chicago and Springfield. The Chicago GTD 4600 PBX currently has limited capacity for voice tie lines to other type PBXs located in other cities. The CSD T1 network group has explored other types of facilities for satisfying high-volume traffic routes in Illinois. The T1 unit has discovered that fiber cannot be used in some areas of Chicago because the state does not have right-of-way access to office buildings. Also, microwave cannot be used in Chicago because of spectrum congestion in this area.

Future Changes to Existing Networks

The T1 network group has received a request from the State Police to provide a wideband data link into the Carbondale area for the AFIS lab application to serve the southern part of the state. Also, this group is reviewing additional T1 network routes between the following cities:

- Rockford to Chicago
- Peoria to Chicago
- Collinsville to Springfield
- Champaign to Springfield
- Chicago to Schaumburg
- Schaumburg to Springfield
- Champaign to Danville
- Champaign to Chicago

Significant New Communications Requirements

The T1network group is currently analyzing the departmental requirements for point-to-point video teleconferencing between Springfield and Chicago. They are compiling the anticipated traffic load requirements and estimating costs for preparing centrally located video conference room facilities.

The CSD T1 network group has also reviewed the comparative cost and other factors related to grouping the T1 channels into a T3 channel. The cost savings does not appear to be much of a factor compared to other requirements. The T3 consolidation reduces flexibility, reduces multiple vendor competitive advantage to the state, and increases the risk of major circuit outage and agency service disruptions if the T3 ;ome fails.

Communications and Interactions With Other Agencies

The consolidation of individual voice and data circuits into a cost-saving T1 network will effect all major departments and agencies. The T1 network provides maximum agency interaction capabilities and will be expanded to the extent possible based on an individual agency's requirements.

AGENCY INTERVIEW RESULTS

Agency Interviewed: CMS/CSD Radio Section
Person(s) Interviewed: Gary Cochran, John Meyers
Type of Interview: Personal
Date of Interview: February 23, 1987

Agency Functions and Missions

The CMS/CSD Radio Section provides systems analysis support for radio and microwave services at all state agencies that have radio services.

Significant Existing Communications Requirements

The CMS/CSD Radio Section is currently providing support analysis for radio and microwave systems to the State Police, Department of Conservation, and Department of Nuclear Safety.

Networks that Satisfy these Communications Requirements

The State Police currently have a point-to-point analog microwave network in strategic locations in the state. This network is supplemented with leased analog circuits to police dispatch facilities.

The State Police radio network is a 200-channel capacity Motorola system. The State Police use only six to eight channels of the total system capacity.

Future Changes to Existing Networks

CMS Radio group is planning to add a point-to-point microwave Raycon 12 system on top of the CMS building and DNS building 8 in Springfield for the Department of Nuclear Safety.

Significant New Communications Requirements

The CMS/CSD Radio unit anticipates a requirement for an 800-MHz system located in Chicago for the State Police. The Illinois State Police will be taking over the patrol duties from Chicago police for river and interstate patrols in the Chicago area. The State Police also anticipate a future need for data transfer terminals over radio channels for police patrols. Only one known vendor currently provides single sideband service for data transfer facilities.

The CMS Radio group provided a reference copy of a 1983-84 statewide microwave system report to NSI. The report included a recommendation for upgrading the existing microwave system to a digital statewide backbone network to be completed in four phases and costing $28.5 million. There apparently was no action taken to implement the recommended digital micowave network.

Communications and Interactions with Other Agencies

The CMS Radio group currently has interaction with all other state agencies that have radio or microwave facilities. These include the following:

- Illinois State Police
- Department of Corrections
- Department of Conservation
- Department of Mental Health
- Department of Nuclear Safety
- Secretary of State Police
- Department of Transportation

AGENCY INTERVIEW RESULTS

Agency Interviewed:	**CMS/Office Automation (WANGNET)**
Persons Interviewed:	**John Ebersohl, Ron Letterly**
Type of Interview:	**Personal**
Date of Interview	**March 10, 1987**

Agency Function and Mission

This group was created at the direction of the Governor to implement WANGNET office automation services in all departments and agencies under the Governor.

Significant Existing Communications Requirements

Voice

Not applicable

Data

CMS indicated they have approximately 400 WANGNET users currently on line. The CMS office automation group is installing a broadband backbone network in the Springfield and Chicago areas. The Capitol building, Waterways building and the CMS computer building have been equipped with the WANGNET broadband network. Other agency buildings will be surveyed for installing the modular designed FASTLAN/WANGNET. Also, a small VS6 is being installed at selected locations, to be used with WSM connections.

Video

The existing WANGNET broadband system is currently equipped in the capitol complex for video transmission. AT&T is exploring the feasibility of connecting the video channels between Chicago and Springfield using a WSN connection.

Future Changes to Existing Networks

The CMS Office Automation group plans to use the Wangnet E-mail between all offices and departments in the Springfield and Chicago areas.

WANGNET will be installed in the new regional office building in Rockford, when constructed.

Other agencies being considered for installation of the FASTLAN/WANGNET system are Public Health, Public Aid, and Department of Revenue.

CMS is exploring the possibility of integrating voice technology with WANGNET and the use of optical scanners for CAD applications in the near future.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Children and Family Services
Person(s) Interviewed: Susan Flannagan, Augie Egger, Kathy Shaw
Type of Interview: Personal
Date of Interview: March 11, 1987

Agency Functions and Missions

The Department of Children and Family Services (DCFS) seeks to protect children and strengthen family life in Illinois. Department services include investigation of child abuse and neglect reports; family counseling; care of children in foster homes, group homes and institutions; adoption; day care and the licensing and monitoring of 20,000 child care facilities. The department is organized into five divisions with 2,600 employees, providing administrative support for the following programs associated with each division:

- Management and Budgets (EDP)
- Program Operations
- Child Protection
- Policy and Plans
- Youth Community Services

The state is subdivided into eight regions with five to twelve field offices per region. Springfield is the central headquarters for all regions. Chicago and Cook County have satellite offices with 1,000 of the total 2,600 employees.

Significant Existing Communications Requirements

Voice

All Department voice services provided by CMS are shared Centrex or PBX/key services at remote locations.

Data

The Department has 225 field office terminals with IBM 3274, 3276, and 3278 devices connected on multipoint circuits to the CMS central host computer.

The Springfield headquarters has an IBM 8130 which runs as an RJE device to the CMS host. Springfield also has an IBM 8140C for a child abuse status reporting application.

The Peoria region currently has an IBM System 36 with 3180 terminals. The System 36 is connected to CMS with dedicated 9.6-Kbs circuits and appears to the CMS host as a 3270 RJE device.

Future Changes to Existing Networks

DCFS plans to convert all regions to System 36. The Department is currently decentralizing data entry to the field and currently uses PROFS at most locations. DCFS does not use WANGNET but plans to bridge to WANGNET using PROFS later. DCFS has requested dial-up PC access to the Chicago data base from Peoria field offices.

DCFS has a need to interface with the CMS personnel system record base for its processing and record keeping requirements.

DCFS plans to migrate to office automation services, with the System 36 conversion completed by FY 1990 for all regions.

The State Central Register System for hot-line child abuse reporting is now at maximum capacity. DCFS must issue an RFP to upgrade this box.

Ultimately, DCFS plans to link the hot-line system and the 8100 field office locations so that the case worker and user can have immediate access to this data base. No requirements are foreseen for microwave, radio, or video applications.

Communications and Interactions with Other Agencies

There are two basic interaction requirements with other agency networks. The existing Health Maintenance Operation needs to be interconnected with Public Aid applications. DCFS currently has three Perkin-Elmer terminals connected and has heavy usage. The State Police also need file access capability for checking missing children.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Commerce and Community Affairs
Person(s) Interviewed: Marvin Sprague
Type of Interview: Personal
Date of Interview: February 27, 1987

Agency Functions and Missions

The Department of Commerce and Community Affairs (DCCA) is responsible for promoting economic development in Illinois. The Department works to enhance the business and working climate to stimulate economic activity, expand employment in the private sector, and to increase economic opportunities and self-reliance among Illinois citizens.

Significant Existing Communications Requirements

Voice

The DCCA Headquarters voice requirements consist of CMS provided Centrex service and IDDD to international offices.

Data

Currently, DCCA has 58 IBM PC's with dial-up connectivity to CMS central computer applications programs. There are some dedicated 9600-bps lines connected to CMS. The field locations also have a few 4800-bps multidrop circuits with 3274 SNA/SDLC Harris equipment connected to CMS computers. The international offices in Belgium, Hong Kong, Japan, Brazil, and China have PC micros but are not linked to the CMS computer center. The DCCA international office telecommunications facilities are shared with the Department of Agriculture.

Video

Networks that Satisfy these Communications Requirements

CMS provides all dial-up and leased-line facilities to satisfy DCCA's requirements.

Future Changes to Existing Networks

DCCA would like to have dial-up access to all foreign city locations where trade mission or trade conferences are held.

For its data systems, DCCA would like to have CMS provide an asynchronous interface with its SNA system.

Significant New Communications Requirements

DCCA would like CMS to provide video conferencing between Springfield and Chicago.

Communications and Interactions With Other Agencies

DCCA identified some areas in which there is a requirement to interact with other agency systems. DCCA needs to share database files and information with the Chicago City Employment Bureau. It also needs to be connected with the Department of Human Services via an SNI gateway in Chicago and the Department of Public Health in Springfield.

AGENCY INTERVIEW RESULTS

Agency Interviewed:	**Department of Corrections/Data Processing Systems**
Person(s) Interviewed:	**Dave Clark, Larry Lechtenberger**
Type of Interview:	**Personal**
Date of Interview:	**February 23, 1987**

Agency Functions and Missions

The Department of Corrections (DOC) provides incarceration for adult and juvenile prisoners at 19 adult prisons, seven juvenile facilities and nine work release work centers.

Significant Existing Communications Requirements

Voice

Voice and PBX systems are ordered through CMS.

Currently, the Springfield location is served by a ROLM PBX. The other DOC locations are served by a variety of vendor PBX systems, including:

- AT&T
- CONTEL
- GTE
- ROLM

Data

DOC's data systems consist of Hewlett-Packard 3000 series 68 system hosts located in Springfield and one hundred and thirty-one 3226-type terminals and 60 Telex terminals at remote locations which connect to the Springfield host.

Networks that Satisfy these Communications Requirements

Dial-up service is used primarily for voice systems at 28 PBX locations. Also, DOC has Centrex OPX lines from Springfield to each PBX.

Currently, DOC has 12 leased circuits statewide for CIMIS network data services. Six of 12 leased circuits are point to point . Six circuits are for multipoint 9.6 Kbs routes. There are two 9.6 Kbs circuits for the JMIS network between Springfield and Chicago and Concordia. The HP system has 14 lines to CMS IBM using an HP gateway.

Future Changes to Existing Networks

The following items were discussed as minor changes to existing networks:

- July 1987: moving to new building in Springfield
- 1987: adding 30 more terminal devices on the data network
- 1988: changing out 200 Hewlett Packard terminals
- Within five years: up to 800 terminal devices added to the network

Significant New Communications Requirements

None

Communications and Interactions with Other Agencies

The Department of Corrections in Springfield currently has gateway capability from its HP systems and 14 lines connected to the CMS IBM system.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Corrections/Radio
Person(s) Interviewed: Bill Lehman, David Clark, Judy Blahofski
Type of Interview: Personal
Date of Interview: February 27, 1987

Agency Functions and Missions

The Department of Corrections (DOC) provides secure incarceration for adult and juvenile prisoners at 19 adult prisons, seven juvenile facilities and nine community work release centers. This group oversees all voice and radio communications requirements for the DOC.

Significant Existing Communications Requirements

Voice

Prison facilities are served by various types of PBX services ordered through CMS. Each PBX has SMDR/CDR capability. Most PBXs have Centrex OPX tie-lines from the Springfield Centrex to each prison PBX system.

Voice/Radio

DOC has 41 base station locations in its state radio network.

Data

The DOC administrative data system consists of IBM 5520-type terminals at 30 locations statewide. The terminals currently use dial-up access to the CMS IBM host in Springfield. DOC is in the process of changing some of the dial-up lines to dedicated connections but is leaving dial-up lines for backup.

Networks that Satisfy these Communications Requirements

DOC uses the public dial exchange networks for its PBX and Centrex voice services.

The DOC administrative data network, consisting of 5520-type terminals, currently uses 2400-bps dial-up lines to access the CMS IBM host.

The CIMIS and JMIS dedicated data networks connected to the two Hewlett-Packard computers at the Springfield headquarters were discussed in an earlier interview summary. There are no known fiber or microwave facilities or networks for DOC operations.

Future Changes to Existing Networks

DOC plans ultimately to have 25-30 systems/locations using 5520-type terminals linked to the CMS computer. The Department is now in the process of changing some locations to dedicated leased lines but leaving the dial-up facility in place as 5520-type terminal backup.

CMS is making arrangments for adding DISOSS to its central compuers, to provide additional applications such as electronic mail, document distribution, library listings, manuals, and records updates. DOC plans to complete this configuration in one to two years.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Employment Security
Person(s) Interviewed: Herbert Rush
Type of Interview: Personal
Date of Interview: February 27, 1987

Agency Functions and Missions

The Department of Employment Security administers the unemployment insurance and job service programs for the state. The Department collects unemployment contributions and taxes from 240,000 liable employers and pays benefits to eligible workers. All unemployment insurance and job service program operations in 118 locations have been consolidated into 63 unified field offices statewide. The field offices are linked with and administered through 13 regional offices.

Significant Existing Communications Requirements

Voice

The Department currently uses CMS voice facilities at all locations.

Data

The data network is tied directly to the CMS central computers. Chicago office locations are linked to an IBM 3725. The 3725 is linked to CMS Springfield via the CMS T1 network. CMS provides a 4341 RJE host and a 4381 host for program development.

Each county sends data to the regional offices located in Rock Island, Peoria, Belleville and Springfield. These offices batch data to CMS in Springfield.

Video

Future Changes to Existing Networks

There are no plans to change existing networks.

Communications and Interactions with Other Agencies

None. All services are provided through CMS.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Public Aid
Person(s) Interviewed: Beverly Knous, Gary Johnson
Type of Interview: Personal
Date of Interview: March 10, 1987

Agency Functions and Missions

The Department assists over one million residents who are experiencing financial or medical hardship.

The Department administers the following programs:

- Aid to Families with Dependent Children
- Medical Assistance Program (Medicaid)
- Food Stamp Program
- General Assistance Program
- State Supplemental Payments
- Aid to the Medically Indigent
- Child Support Enforcement Program

The department has 9,000 employees, 170 facilities, and six downstate regional offices. There is a Public Aid Office in every county, usually at the county seat, and several office locations in larger communities such as Chicago.

Significant Existing Communications Requirements

Voice

The Public Aid voice facilities and services are provided by the CMS Springfield Centrex system or PBX systems. Likewise, all voice needs at remote field offices are satisfied by CMS.

Data

Public Aid has two data networks using Sperry and Concurrent computers. The largest network consists of 21 Concurrent Computers 3230 (Perkin-Elmer) working as SNA controllers with 2000 terminals (3270's) connected on multiple drop circuits.

The Sperry SNA data network connects the eight regional locations to CMS via 9.6-Kbs point-to-point circuits.

Networks that Satisfy these Communications Requirements

The Concurrent Computers are located at node offices and the county field offices are connected mainly with point-to-point circuits to the node computers. The county offices transmit 400,000 transactions per month to each node computer. The node computers are linked back to a CMS host computer. The CMS host transports 200,000 transactions per month to each node. Approximately 120 terminals are connected to each node. The Chicago, Aurora and East St. Louis nodes have approximately 200-225 terminals (3282's) connected to each node.

In addition, Public Aid has a Sperry computer system connecting eight regional offices for child support applications. The Sperry network is an SNA system connecting two central region locations in Springfield and Chicago, each with 5000/90-type devices and six regional offices with 5000/80 machines. Each regional computer is connected to CMS via point-to-point circuits except for Belleville (E. St. Louis), which uses a multidrop circuit. Each regional office computer has multiple SVT-1220-type terminals connected to it with a variety of printers at each location. The office with the least devices is Marion which has six terminals, and three printers. The largest office is Aurora, with 16 terminals and seven printers. Peoria has 11 terminals, six printers, and four satellite locations.

The Public Aid Headquarters building has a WANGNET 300 System.

Future Changes to Existing Networks

Public Aid expects new terminals to be added to the network, but no new nodes or regions. Public Aid will add only one new office per year to the existing networks. The network growth is driven by the size of the welfare base and new applications that are added to the system.

The Springfield headquarters will expand into a new building in the 1988-89 time frame, and this will require some changes in the way existing systems are connected through CMS. Public Aid expects to link the two headquarters buildings with a fiber cable. Also 160 Nixdorf terminals will be moved to the new building, along with seven 3274-type controllers.

Significant New Communications Requirements

Public Aid is currently reviewing its future requirements for new networks or systems to meet the following applications.

- A new network or system to provide cash assistance to pre-approved clients via Automatic Teller Machine type terminals at many locations statewide.

- A Photo ID network to store and retrieve picture images from 63 office locations in the state, plus produce identification cards for clients.

- Public Aid is exploring the possibility of a new network or leased system to allow medical providers to perform medical eligibility verification. This service could be a leased system through a "credit card" company or service bureau.

- Executive level management would like to have a video conference network for selective point-to-point or broadcast video teleconferences with its administrative and regional offices and perhaps with other agencies in the Chicago and Springfield areas.

Communications and Interactions with Other Agencies

The Department of Public Aid indicated they have frequent need to interact with other agencies on various matters. The agencies Public Aid most frequently requires system interactions with include the following:

- Bureau of Employment Security
- Circuit Court Clerk in Chicago needs to be linked to Public Aid offices in Springfield
- Chicago Metropolitan Health Care Council
- Secretary of State data system
- Public Health
- Comptroller

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Public Health Data Processing
Person(s) Interviewed: Tom Stuckey
Type of Interview: Personal
Date of Interview: February 24, 1987

Agency Functions and Missions

The Department has four offices which administer more than 100 programs and services aimed at illness prevention, control of potential health hazards, and regulating health care facilities. The Department has three laboratories, located in Springfield, Chicago and Carbondale. The Department also has a Divison of Vital Records that officially registers all Illinois births, deaths, marriages, and divorces.

Significant Existing Communications Requirements

Voice

All voice services are provided by CMS.

Data

Data requirements consists of PC data message distribution between eight regional offices and the Springfield Headquarters.

Video

None.

Networks That Satisfy These Communications Requirements

The network that supports the emergency disease reporting system is dial-up lines that link 75 PCs at county and city offices with Springfield.

The Vital Records Office is linked to regional offices via multidrop leased lines from the CMS Springfield computer center which processes automatic record searches statistics and records updates.

Future Changes to Existing Networks

The existing women and infant care program is rapidly expanding with 200 clinics at statewide locations and each clinic has one to eight PCs. The department will also be adding three to four lab locations for disease control/reporting and will

need two-way connectivity with regional offices and CMS Springfield. The Vital Records Office in Springfield will be directly linked to the DuPage and Cook County remote centers to allow direct input of new birth records updates.

Significant New Communications Requirements

This department will eventually need a distributed data transfer and inquiry system to link all clinics, labs, and regional offices together with two-way access to the main CMS data base in Springfield. This would replace the current dial-up polling message transfer system.

Communications and Interactions with Other Agencies

Public Health indicated that its major interaction is with the CMS main computer center.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Department of Mental Health
Person(s) Interviewed: George Tinsley, Weldon Stetter, Larry Harris
Type of Interview: Personal
Date of Interview: March 11, 1987

Agency Functions and Missions

The Department of Mental Health provides services for the care and treatment of mentally ill and developmentally disabled persons. The Department's activities are coordinated by a central administrative staff, six regional field offices, 23 state residential facilities, three state research and training institutes and over 500 community-based residential and daytime activity programs.

Significant Existing Communications Requirements

Voice

The Springfield headquarters staff uses the main CMS Centrex system for its administrative voice calling requirements. Many of the Department's existing hospital facilities at remote state locations have old, obsolete phone systems and the Department is upgrading these facilities on a gradual basis. The bulk of the calling is in-state from Springfield headquarters to each hospital and calling between hospital facilities.

Data

The Department of Mental Health has two major networks that support its health care facilities and programs:

- Customer Information Control System (CICS)
- Clinical Program Support System (CPSS)

The CICS network is a host computer with administrative applications. The host is located at the CMS computer center in Springfield and is an SNA system. The network consists of multidrop terminals linked to Harris controllers. Each controller has an average of seven terminals connected per circuit. The controllers are linked to the Springfield CMS Center via dedicated circuits from 20 hospitals.

The CPSS network consists of IBM 8100's located at Rockford, Chicago, Springfield and Anna. The CPSS runs an in-house patient applications program to track patient status and other patient treatment and care requirements at community clinics and the state hospitals. Approximately 40 clinics are connected to the IBM 8100's with dedicated 9.6-Kbs circuits. Each hospital facility has E-mail using a DISOSS package and uses display writers as terminals.

Video

Future Changes to Existing Networks

The Department plans to continue using the CPSS IBM 8100 network as the system expands. Growth is expected to add 100 communities to the existing network over the next five years. Mental Health would like to offload the Chicago circuits from the Rockford 8100 to a new 8100 for the Chicago area.

The CICS system needs some changes. The existing Harris controllers do not provide file transfer capabilities. There are also other limited capabilities which may require complete replacement of the Harris equipmment. Mental Health is currently testing the feasibility of an IBM token ring LAN at its Springfield locations. Some community locations cannot be connected to the LAN without adding cost(s) repeaters or bridges. Mental Health is also exploring the possibility of migrating to PC terminals at each hospital and this has the potential for adding 400 users into a PC network.

Communications and Interactions with Other Agencies

There is very little direct interaction with other state agency networks and systems. Mental Health shares its payroll application program on the CMS computer system with several other agencies, including the Department of Corrections, Department of Conservation, Department of Children and Family Services, and the Historical Sites Preservation Commission. Mental Health uses an interagency user charge-back arrangement to cover the shared cost of this program.

AGENCY INTERVIEW RESULTS

Agency Interviewed:	**Department of Transportation**
Person(s) Interviewed:	**Ray Fillipiak, Charles Gurgens**
Type of Interview:	**Personal**
Date of Interview:	**March 10, 1987**

Agency Functions and Missions

The Department of Transportation (DOT) is responsible for the design, construction, operation and maintenance of the state highway systems and for the administration of the state's local roads and streets program. Nine district offices are responsible for carrying out all of the Department's work in the state. In addition, the Department oversees the state's inland waterway system through regulation of rivers, lakes and commercial water navigation. The Department is also responsible for developing aviation safety programs, providing emergency medical transportation, and for giving administrative assistance to the Civil Air Patrol.

Significant Existing Communications Requirements

Voice

DOT is colocated on the CMS Centrex system and shares the use of its tie lines and WATS service. The Department has three to five Centrex OPX lines to each of its nine district offices. It has a direct access tie line between Springfield Headquarters Centrex and its largest district office PBX at Schaumburg. The Springfield Headquarters has a 15-position ACD with 15 WATS lines for highway department truckers to call in on work maintenance dispatch.

DOT uses very little microwave but does have radio facilities in each district. From its Central Office, DOC can talk to nearly anyone in the state. Schaumburg district has six radios (plus two spares) which are used for monitoring expressway traffic and key intersections into Chicago.

Data

DOT has DEC 8100 host processors at the Headquarters and each of the nine district locations. The 8100's are linked to Springfield with multipoint 9600-bps dedicated circuits. The 8100's perform RJE and IMS applications with headquarters. The Schaumburg district has a VMS 100 application, but no connection with CMS/VMS. The DOT headquarters also has dual 8700 VAXs which do not interface with the CMS SNA system. DOT has an Integraph system at headquarters that is used for CAD/CAM centralized applications design and sent out to each district. The Department is now beginning to install a VAX micro system in districts 1, 2 and 5.

DOT has eight to nine bisync 3277 terminals and five to six SNA terminals connected to CMS computers.

The DOT headquarters building currently has a FASTLAN Wangnet with office automation functions that include dial access OIS-140 WANG.

Future Changes to Existing Networks

DOT is currently in the process of developing a maintenance management system that will be linked to each county. The main processor will be a MICOM 8000 with up to 160 terminals linked via 14 multidrop 9.6-Kbs dedicated leased circuits to the Springfield headquarters dual 8700 VAX systems.

DOT will install six additional VAX micro systems in district offices #3,4,6,7 and 9.

Each district will also receive Wang word processing system with printers.

Significant New Communications Requirements

DOT plans to open a new district office in Peoria and will require voice and data communications similar to those in other districts.

DOT plans to refine and upgrade some of the radio dispatch system and equipment.

DOT is exploring the level of executive interest in video teleconferencing between Springfield and Chicago.

The overall growth and expansion cycle for DOT is nearly complete as regards major new requirements. The Department foresees requirements for ongoing maintenance in all areas of its operation.

Communications and Interactions with Other Agencies

The Springfield 8100 host is linked to the CMS mainframe via 3010 with LDMs for inventory, time reporting, worksheets, truck parts, and equipment ordering applications programs. DOT has 26 circuits between DOT headquarters and the CMS Computer Center.

DOT has limited interaction with other agencies. It has a small amount of interaction with the State Police for inquiry to the LEADS data base, and the State Police use the DOT Radio transmission network.

AGENCY INTERVIEW RESULTS

Agency interviewed: Illinois State Board of Education
Person(s) interviewed: Kenneth Smith, Dr. Bill Grant, Dennis Powell
Type of interview: Personal
Date of interview: February 26, 1987

Agency Functions and Missions

The State Board of Education (SBE) sets state educational policies and guidelines for public and private schools, from preschool through grade 12, as well as for adult and vocational education. It analyzes the aims and needs of education and recommends legislation to the General Assembly. It also acts as a conduit for channeling state and federal funds to state, public and vocational schools.

Significant Existing Communications Requirements

Voice

At the state level, all voice services are provided by the CMS Centrex system.

Data

All data applications are currently provided by the CMS Central Computer Center. The Board has seven direct lines to the CMS data center for running its various data applications programs related to funding flow and audit control. Teacher certification programs are maintained in the Illinois Management System (IMS) data base.

Networks That Satisfy These Communications Requirements

The Board offices in Springfield primarily use dial-up and directly connected leased lines for its voice and data needs.

Future Changes to Existing Networks

There are no immediate or future plans to expand or change the existing systems.

There are no plans for a distributed data processing system.

No new applications or requirements are being pursued by SBE. There are no special video requirements.

Interaction with Other State Agencies

There are no special requirements in this area. The existing, voice and data systems satisfy the Board's total need in this area.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Illinois State Lottery/Data Processing
Person(s) Interviewed: Dave Bosch, Larry Sipes
Type of Interview: Personal
Date of Interview: February 26, 1987

Agency Functions and Missions

The State Lottery was created in 1974 to increase the state's revenues. In the first fiscal year of operation the lottery grossed $887.6 million. The lottery currently gorsses $25 million per week for the State. The introduction of automated games has contributed to the lottery's tremendous growth and popularity.

Significant Existing Communications Requirements

Voice

The lottery currently shares the existing CMS Cenrex service for voice requirements and has a 900-type call-in line to announce winning numbers.

Data

The lottery data requirements consist of connectivity to six regional office locations, three district offices, and 3256 terminals spread over 102 counties. There is a direct line to the Comptrollers Office to check outstanding warrants on lottery winners before arranging payouts.

All sales representatives have portable PC's and at the end of the day dial up district offices and download data to an Olivetti computer. The district office computer compiles all data from regions and downloads its data to the central CDC computer to update the data base daily.

Video

None

Networks That Satisfy These Communications Requirements

The lottery contracts for leased multidrop circuits from AT&T to connect the 3256 terminals from across the state. It has approximately 120 multidrop circuits with 15 terminal connections per circuit connecting to the central computer in

Springfield. The lottery also has a direct link from the Chicago area via T1 to the Springfield computer. The lottery has from eight to ten circuits for its district and regional processing needs.

Future Changes to Existing Networks

The lottery group plans to add ATM-type vending machines or player activated terminals with direct link to the central computer. Lottery management also plans to have 16 WATS lines connected to some kind of voice response system at the Springfield headquarters location to allow field agents to call into a voice mail exchange and key pulse in current sales data to a Burroughs type system which converts key pulse codes into digital codes for daily updating lottery computer data base.

Significant New Communications Requirements

The current growth of data terminals will exceed the CDC System contract cap at 5,000 terminals and the lottery group plans to prepare an RFP for an entirely new computer system. This RFP will include requirements for a turnkey dual computer system with circuits, terminals, training and network management to be provided by the successful bidder.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Illinois State Police/Data Processing
Person(s) Interviewed: Dick White, Jim Morris, Ernie Winsler, Robert Zak
Type of Interview: Personal
Date of Interview: February 26, 1987

Agency Functions and Missions

The data processing group provides computer support for two state mandated programs: Law Enforcement Administrative Data Systems (LEADS) and Traffic Information Processing Systems (TIPS)).

Significant Existing Communications Requirements

The existing LEADS system contains 1500 Western Union terminals with 400 connections to the system. Local, county and city police (non-state agencies) order and pay for their circuit connectivity to the network.

The TIPS system has approximately 280 Honeywell terminal devices connected from statewide locations into a Springfield IBM 3038 with VTAM/TCAM/SNA capabilities. The system also has some bisynchronous 2770 terminals connected to the system.

Networks That Satisfy These Communications Requirements

The LEADS network has directly leased line circuits connected from statewide locations hubbed to the Springfield central computer.

The TIPS network is connected via 120 leased lines, which include 85 multidrop circuits running at 2400 bps. Most of the 280 terminal devices that are connected to the networks are the Honeywell 1510 type.

Future Changes to Existing Networks

Currently, the police data systems are growing at less than 10 percent per year and the message traffic is growing at a little more than 10 percent per year.

The police data group is planning to add more PC's with dial-up access to the main computer data base. They will also add six system 36's to the network in the near future.

Significant New Communications Requirements

A new stand-alone computer will be added at the new Joliet Lab to run the AFIS fingerprint identification system. Other police laboratories across the state will be connected to Joliet via 56-Kbs circuits with Thermofax terminals.

The police network needs could double in the next five years. There will be 30 to 40 new locations added to the network and these will require new circuit connectivity.

Communications and Interactions with Other Agencies

Shared data base requirements from other agencies will increased dramatically in the next five years. Public Aid and SOS DMV license system inquiries and message transactions will need more circuits and terminals to access the police data base.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Illinois State Police/Radio Section
Person(s) Interviewed: Darrel Bartz
Type of Interview: Personal
Date of Interview: February 24, 1987

State Functions and Missions

The Illinois State Police are responsible for providing police protection and enforcing criminal statutes. Police officers patrol Illinois highways, investigate law violations, and provide technical assistance and support to other law enforcement agencies.

Significant Existing Communications Requirements

Primary system consists of an analog voice radio/microwave relay system that provides for constant contact with police patrol vehicles. It currently provides dispatch support for eight agencies in addition to the State Police.

Networks That Satisfy These Communications Requirements

The radio system has 600 has a capacity of channels capacity. The police are licensed for 40 channels and only 23 channels are currently activated in various parts of the Radio Network State Police Radio system. The Police Radio Network consists of 78 transmit-and-receive sites. It also contains limited microwave capabilities at remote relay sites. CMS-provided leased lines are used to supplement and interconnect to remote microwave sites and police dispatch centers.

Future Changes to Existing Networks

The department has requested a 1987 budget for a new 800-MHz system located in the Chicago/Cook County area.

A contract has been awarded for a special Thermofax Automatic Fingerprint Identification System to be installed at the new lab location in Joliet, Illinois. This location will be linked to other major city and state agency locations via leased 56-KB data circuits.

Significant New Communications Requirements

The State Police indicated a requirement for Automatic Vehicle Locator (AVL) equipment for patrol cars in selected high-risk areas. They also have a requirement for

four more highband channels for certain locations to provide more complete statewide car-to-car communications . There is a need for a police tactical channel to be added to the current system.

Communications and Interactions With Other Agencies

The State Police currently provide dispatch sevice statewide for the following state agencies and departments:

- Secretary of State Police
- Department of Commerce
- Department of Revenue
- Attorney General's Office
- Fire Marshalls
- Department of Conservation
- Forestry of State Parks

AGENCY INTERVIEW RESULTS

Agency Interviewed: Secretary Of State/Data Processing
Person(s) Interviewed: Jim Settles, Rich Hartman, Ron Thomas
Type of Interview: Personal
Date of Interview: February 23, 1987

State Agency Function and Mission

The Secretary of State (SOS) is primarily responsible for examining and licensing the state's 7 million drivers and issuing 8.3 million license plates and 3.3 million title documents. Also, the Secretary of State functions as the State Librarian, controlling the statewide regional library system.

Significant Existing Communications Requirements

Voice

Voice systems are usually Centrex-type systems and are coordinated at all statewide SOS locations by the Buildings and Grounds group.

Data

The current data system operations consist of two DPS/6-95 Honeywell computer systems with the latest Honeywell software updates.

The Division of Motor Vehicle license operation uses Texas Instrument equipment which is 11 years old. The DMV license system is configured as seventeen 2400-bps multidrop circuits which hub to Springfield.

The Department of Police and the Driver Information System also use ten-year-old Harris equipment at 42 locations statewide . This system is configured on thirty-two 4800-bps circuits connecting 740 terminal devices. The SOS headquarters location currently has a Honeywell LAN Ethernet system using Bridge equipment.

Video

None

Networks That Satisfy These Requirements

SOS uses leased dial-up facilities for its voice Centrex and PBX systems. The data systems are configured to use leased data circuits which connect from field locations to the hub at Springfield. The SOS currently use some short-hop microwave facilities that are shared with the Illinois State Police radio network.

Future Changes To Existing Networks

The SOS has an RFP pending to replace the existing Harris data equipment with microcomputers. Also SOS plans to issue a request for proposal to replace all existing Texas Instruments equipment with a Honeywell Datanet 8 interactive system using a T1 backbone transport facility between locations.

Significant New Communications Requirements

SOS would like to add a DPS/6 computer system at its Chicago location with an X.25 LAN connected to 12 to15 remote terminal locations. The Chicago location then could be linked back to Springfield headquarters with high-speed circuits.

Communications and Interactions With Other Agencies

SOS requires system interaction with the following agencies:

- CMS SNA
- Illinois State Police
- Comptrollers
- Department of Public Aid
- University Libraries
- Local Courts
- IRS Offices

AGENCY INTERVIEW RESULTS

Agency Interviewed: Secretary of State/Department of Police
Person(s) Interviewed: Director, Dave Watkins, Rob Miller, Ron Cobbetto
Type of Interview: Personal
Date of Interview: February 25, 1987

Agency Functions and Missions

The primary mission of the Secretary of State Department of Police is to regulate the motor vehicle industry in the State of Illinois with emphasis in the areas of traffic enforcement, auto theft investigation, and vehicle-related consumer fraud.

Significant Existing Communications Requirements

The SOS/Police organization is configured as five district offices in the state, including Chicago (Maywood area), Rockford, Mt. Vernon, and two offices in Springfield.

Voice

SOS/Police need to make and receive voice calls between all locations and to have voice radio connection to patrol cars.

Data

Each district office needs to be connected to two separate data bases. The SOS Honeywell data base provides access to all SOS administrative ADP applications. The other data base requirement is for connection of all district offices to the Illinois State Police Law Enforcement Administrative Data Systems residing in the CMS IBM Computer Center.

Video

None

Networks That Satisfy These Communications Requirements

The SOS district offices use the public message network for voice calling between offices. They also use150-Mhz mobile radio communications to contact patrol cars in the Springfield and Chicago areas.

The district offices each have dual data terminals and are connected on two separate data networks. Each district has a Western Union terminal connected to multidrop circuits homing to the LEADS program residing in the CMS Computer Center in Springfield. Also, the district offices have a Harris terminal connected on a direct leased line to the SOS Honeywell computer located in Springfield.

Future Changes to Existing Networks

SOS plans to make the following changes to its mobile radio systems. The undercover car units assigned to the East St. Louis area will get Phoenix units. The regular patrol cars will get Centurion units. No major changes are planned for the data networks.

Significant New Communications Requirements

The SOS/Police would like to be able to access the Revenue Department data base to obtain motor vehicle sales tax information to aid in its investigative work.

The SOS/Police Director indicated a desire to add his mobile radio networks to a satellite system to obtain statewide contact with all patrol units.

Interaction With Other State Agencies

Other agencies such as department of Nuclear Safety and Department of Conservation are requesting connection to or sharing of the mobile radio networks.

AGENCY INTERVIEW RESULTS

Agency Interviewed: University of Illinois/Champaign
Person(s) Interviewed: Jack McMannus, Ed Krol, Joe Donaldson
Type of Interview: Personal
Date of Interview: March 9, 1987

Agency Functions and Missions

The University of Illinois (UI) has been a leader in developing its three-fold mission -- teaching, research, and pubic services -- which is the unique feature of a state land-grant university.

Significant Existing Communications Requirements

This interview included the following major areas of the University's program development and administrative operation:

- Research Instructional Computer Center
- Continuing Education Programs
- University Administrative Operations

Research Computer Center

Two requirement areas were discussed that relate to the Research Computer Center.

- Development of wide-area networking to connect the Research Computer Center of the big-ten universities to the Illinois Center.

- Requirements to advance the super-computer project as part of a National Science Foundation (NSF) grant.

The NSF grant was made to UI to manage the super-computer system for one year. It currently has Kodak as an industrial partner in its research program and UI is looking to obtain other industrial companies and universities to link up with this research project.

The individual users are to be connected to the super-computer center at their own expense. UI currently has five 56-Kb lines into the center in addition to the Kodak T1 access link.

A group of the big-ten universities recently made a proposal for the NSF to provide wide-area T1 data networks to link all of the big-ten computer centers, including University of Chicago, Notre Dame, and the University of Illinois. Currently, the universities are passing graphics on the 56-Kb network and at some point in time the network may crash as data volume over this network increases. The Network needs the T1 NSF backbone in place to prevent a throughput crash of the network.

Continuing Education

This interview covered two program areas related to continuing education:

- The broad spectrum of courses in the program and the need to offer these courses at locations statewide.

- Off-campus degree programs provided by the Continuing Education Department.

The most important requirement is for off-campus continuing education programs and courses. There are major requirements for business courses at business locations, and for local government sites that require off-campus courses at county and city locations.

The current off-campus degree program offers six to eight degree credit courses over its Telenet system. The Telenet teleconferencing network is a 14-port multipe circuit bridge in Champaign which can be reconfigured for any combination of calling locations. There are nine circuits available on a separate bridge overlay and all bridges are used continously 8 hours per day. The Telenet system is supplemented with the AT&T electronic blackboard on bridged circuits at six off campus locations.

The Continuing Education program also provides audio teleconferencing for courses to each county, which serves the needs of county extension service groups.

Other off-campus requirements include research and academic networks using the multi-campus broadband SYTEK LAN that is connected to Chicago Medical School campus using a microwave link.

University Administrative Operations

The existing voice system consists of (two) DMS-100 PBX's at Chicago and Champaign, with smaller SL-1 PBX's to be installed at extension campus locations in Peoria and Champaign. These PBX systems are linked together with (four) T1 channel tie lines. Also, these new PBX systems are linked to other state Centrex and PBX systems at Rockford and Springfield with multiple tie line dedicated circuits. The

Champaign DMS also has FTS autovon circuits connected of faculty research program coordination with federal government agencies. The new DMS on-campus voice system is linked with fiber between five MDF node locations and fiber to 50-70 campus buildings.

Administrative computing and data operations encompass two major data centers, at Champaign and Chicago. Both centers are managed by the Champaign center. The data network is primarily an SNA network at both locations, with over 800 terminals connected to the network. The front-end at Champaign is connected to Chicago via two T1 links for data transmission.

The administrative network standard connection is a 19.2-Kb circuit using gandoff modems on campus and has ACF2 password security levels on the networks.

The administrative data network also includes a library network to 25 state locations with 800 terminals connected. The system uses TCAM working with an old network design. The library network is in the process of being redesigned. The library network supports junior colleges, other universities and off-campus users which make up 25 percent of total terminals on the system. The library system includes a fleet of bookmobile trucks to deliver books anywhere in the state within 48 hours.

Future Changes to Existing Networks

The University administrative network future requirements could possibly include migration to some kind of statewide packet switch network which could support SNA to link all state colleges and universities with other state agencies.

The Continuing Education Department is looking for ways to enhance the existing teleconferencing audio networks with fixed frame video for off-campus locations. The Department considers broadcast video to off-campus locations as much too costly to implement, even though the University currently has on-campus video program production facilities and transmitter sites used by the School of Engineering.

DuPage County College has offered to set up a common use facility for delivery of extension courses from a consortium of state universities that have remote teaching service requirements in that area of the state.

Future teleconference programs are being developed by Continuing Education to offer off campus degree courses for local government, county and city employers in the areas of business and management.

Communications and Interactions With Other Agencies

There appears to be a special need for developing a shared network of data bases between the College of Agriculture at UI, Southern Illinois University, the Illinois Farm Bureau, and the Federal Department of Agriculture regional office to establish and maintain an agriculture information and research data base for common use between these groups.

Telephone Interview Summaries

AGENCY INTERVIEW RESULTS

Agency Interviewed:	**Governor's Commission for Technology Development to Support Small Business Illinois Institute for Technology**
Person(s) Interviewed:	**Norm Peterson, Member of Governor's Commission Steve Sester, Faculty Member, Illinois Institute for Technology**
Type of Interview:	**Telephone**
Date of Interview:	**March 26, 1987**

<u>Agency Funciton and Missions</u>

Explained to Mr. Peterson that this was a follow-up interview from discussions with the Department of Commerce and Community Affairs on March 11, 1987. Also, explained NSI is assisting CMS with a Strategic Network Plan and this was part of the data gathering and needs assessment phase of the project. I advised as a vital part of the data gathering phase we are trying to get a feel for the level of video applications currently being pursued on a statewide basis:

- What type video, point-to-point/broadcast required?
- What applications needed, educational, engineering, research, business?
- How much video bandwidth needed?
- Expected growth next five years?

Mr. Peterson indicated he is working with various large high technology corporations in selected corridors around Chicago that have large R&D departments. These companies include Fermi Lab, Argonne Lab, AMOCO, AT&T Technologies (old Western Electric Corp), Gould Electronics, and Motorola. Mr. Peterson indicated the following items:

1. The high technology corridor is currently in a beginning growth phase and not ready to develop much widespread support for broadcast video as yet. A few companies have point-to-point video in connection with teleconferencing.

2. The State of Illinois is in support of a video development program but has no funds available to install a working system as a resource to small businesses.

Mr. Peterson suggested NSI talk with someone at Illinois Institute of Technology about their video development program. He arranged a call back from Steve Sester.

Illinois Institute of Technology Summary

Mr. Sester indicated IIT has a joint program with Stanford University to develop and use interactive educational video/TV programs. He discussed other program areas as follows:

- IIT provides some course delivery via one-way video, two-way audio at a few corporate sites remote from the main campus.

- Within the Chicago area IIT uses seven of eight microwave channels for transmission from the Sears tower to remote locations for course delivery.

- IIT has an uplink satellite to GEOSTAR in and working but not using for course delivery by IIT.

- Satellite downlinks are everywhere, especially at junior colleges. Junior college enrollments across the state are increasing geometrically.

- Western campus of Dupage County is building a campus extension along the Illinois business development corridor 30 to 50 miles, including Kane, DeKalf counties and Oakbrook area where the AT&T R&D center is located.

AGENCY INTERVIEW RESULTS

Agency Interviewed: Illinois Board of Higher Education
Person(s) Interviewed: Robert Wallhaus, Deputy Director of Academic Affairs
Type of Interview: Telephone
Date of Interview: April 22, 1987

Agency Functions and Missions

Explained the nature of the call and NSI's role with CMS/Illinois Project.

Explained that from the Advisory Committee meeting on April 13, 1987 the impression NSI got was that Higher Education requirements for video in the state have not been fully explored and that there is video application/development planning by Higher Education that NSI should pursue and include in its strategic network plan.

Mr. Wallhaus (Deputy Director of Academic Affairs for Illinois Board of Higher Education) explained that based on the meeting presentation and discussion afterward with Brian NeSmith and Jeff Held there would be a follow-up meeting between NSI and Messrs. Wallhaus, Wagner, and others to brain-storm future applications and requirements for Higher Education to identify "what should be done" in connection with strategic networks for Higher Education as contrasted with "what is being done now."

Mr. Wallhaus explained that Mr. Tristano's view of this project is that Illinois is lagging behind other states in using technology to advance state government operations and Higher Education within the state.

Mr. Wallhaus explained that the Advisory Committee is counting on this project and report to be a strong positive influence on future development and activities by the state. Mr. Wallhaus didn't want the current impression, that there is limited requirement or support for video broadcast network by Higher Education, to be construed as a negative influence on the state strategic network plan.

Mr. Wallhaus' main point is that video requirements are not the main concern nor are there any strong proponents for video on the committee. The concern is that the committee members don't want the limited Higher Education approach for video use in the state to be viewed on this project as a ho-hum mediocre response to a potentially high-impact future requirement.

Mr. Wallhaus explained further that there are currently 340 degree program sites in the Chicago area and this is expected to double in the next five years. There is a big need for engineering degree credit programs in the Schaumburg, Arlington Heights, and Aurora areas of Chicago. If the need is great enough in this area, the potential impact at the state level could be to build a public eduation engineering campus at an

approximate cost of $100 million. This impact on state funds exceeds the potential cost of a state network, which could also meet this Higher Education requirement at a far lower cost.

Received a call back from Bill Glaeser, station manager for WIL-TV, Channel 12 on behalf of Don Mullaly.

NSI explained its role with the State of Illinois and advisory committee concerns for apparent low level state government and university requirements for intercity video broadcast capability related to strategic network planning.

Mr. Glaeser advised that this was similar to a view that was derived from a study made for a Public Satellite consortium. The study was to examine the need for statewide portable satellite uplinks. The study was deemed inconclusive because there was found to be no large-scale requirement or pressing need for this technology. The study results were presented in October 1986 to the Public Radio Commission and the Illinois Public Radio Council. The study results were considered proprietary information to the committee and are not currently available for NSI to review.

The study indicated there was little need for live connections around the state for uplinks. There was some public uplink TV material for broadcast out of Springfield, but otherwise there were too few events at other state locations to make portable uplink commercially viable in Illinois.

However, there has been money funded and approved to provide for the installation of a portable "C" uplink from Springfield and it will be operational in July, 1987. A large potential is developing for 5-KU uplinks on university campuses through available grant money, but there is no evidence of a cooperative effort by the universities to adequately support 1-KU uplink at this time.

APPENDIX B

List Of Illinois Reference Documents

Appendix B — State of Illinois Project Documents List

Appendix B contains a list of pertinent project documents received from various agency or department representatives during personal interviews conducted between February 11, and March 18 1987. Also included are documents received from CMS/ BICS management as part of the project needs assessment process.

The inventory listing of documents includes the document description, agency or department furnishing the document, and the date of the document or date document received.

The documents were used by NSI to complete the needs assessment phase of the Illinois strategic network planning process.

LIST OF ILLINOIS PROJECT REFERENCE DOCUMENTS

FOLLOWING IS A LIST OF DOCUMENTS RECEIVED FROM VARIOUS DEPARTMENT REPRESENTATIVES DURING INTERVIEWS AND FROM CMS/ BICS PROJECT MANAGEMENT.

DOCUMENT DESCRIPTION	DEPT/AGENCY	DATE
Request for Information	CMS	11/24/86
RFI / NSI Response	NSI	12/15/86
Data network summary	Secty State	2/21/87
Data network maps	Dept Corrections	2/23/87
State Police Radio Maps	Illinois State Police	2/24/87
1983 Microwave Network study	CMS/Radio Section	2/23/87
DOC Telco Equip list	Dept of Corrections	2/27/87
State Telephone Directory	CMS/BICS	2/23/87
SCOPE 80s' EDP Plan	CMS	
DOC Telephone Directory	Dept Corrections	2/27/87
DOT Telephone Diectory	Dept Transportation	2/27/87
CMS Telecomm Policy/Guidelines	CMS/BICS	2/23/87
AT&T Tariff No. 10 page 206-212	AT&T Comm	2/27/87
rate center & V&H coord for Illinois		
Map of Counties	CMS	2/27/87

Public Television Station Grants	State Govt. Regulations Manual	
State Senate Bill 1624	CMS	2/27/87
State Govt Procurement Code		
Conference committee report		
Strategic Plan Project Outline	CMS	2/25/87
presentation to blue ribbon panel		
NSI briefing overview document	NSI	2/25/87
Call data analysis printout	BICS	3/25/86
NPA 217 Springfield		
Call data analysis printout	BICS	6/12/86
NPA 312 Chicago		
University of Illinois-	BICS	
6/26/85IBT/DMS 100 Proposal config		
University of Illinois-Report on use	UIC	8/83
of Telecomm in delivery of remote		
education		
University of Illinois-Proposal to	UIC	1/7/87
establish an Agriculture Information		
Science Center		

University of Illinois- Agriculture Summary Report "Competive strategy for American Agriculture"	UIC	3/9/87
Chicago State University- Monahan&Assoc Proposal	BICS	9/23/86
SELL ILLINOIS Booklet	DCCA	3/11/87
Govenors' Program "Build Illinois" Business Financing Programs State programs for business financing support to Illinois businesses	DCCA	3/11/87
ILLINOIS BLUE BOOK	Secty State	1985-1986
RFQ Intrastate WATS	BICS	1/16/87
Dept Public Aid/Info Sys	DPA	3/10/87
Maps of Systems locations		
DSP Printout listing	State Police	3/5/87
Network line count & locations		
State Lottery printout list of Ckts	Lottery	3/1/87
Circuit Verification Report	UIUC	2/27/87
Univ Illinois Urbana/Champaign		

ILLINOIS STATE BUDGET & STATE BUDGET APPENDIX	GOVERNOR	1987/1988
Statewide Network Controller Utilization printout (44 pages)	CMS	2/19/87
Dept Revenue /State Lottery Map of terminals each county	Lottery	2/26/87
CMS organization chart	CMS	3/9/87
Public Aid- MAPS of region nodes, Chicago terminals, and Sperry network map	Public Aid	3/10/87
University of Illinois-Request for Proposal	U of I	3/20/87
Southern Illinois University-Carbondale - Toll Call Analysis Feb. 87 Printout	SIU	3/20/87
BICS-Line Configuration Printout/Controller Utilization	CMS	3/23/87
State Police LEADS Traffic data printout	Police	4/21/87

APPENDIX C

Agency Surveys

Appendix C — Agency Surveys

Appendix C contains a summary of the survey information collected by the survey questionnaire. The survey form is contained in the pages following the survey summary.

The survey form requested information about each agency's existing dedicated and switched *intercity* network requirements. Also, parts 4 and 5 of the form requested information about the agency's future requirements for dedicated and switched *intercity* networks. The survey information provided by the agencies responding to the survey is summarized in Figure C-1. A copy of the survey form and letter of transmittal sent to each agency follows Figure C-1.

The survey summary chart contains the following column headings:

- Agency name
- Existing intercity network requirements
  - type of dedicated facilities required
  - type of switched facilities required
- Future intercity network requirements
  - type of dedicated facilities required
  - type of switched facilities required

Of the fifty survey forms returned 24 forms contained primarily local switched voice requirements identified for both existing and future networks.

Agency Survey Summary

Agency	Existing Intercity Network Dedicated	Existing Intercity Network Switched	Future Intercity Network Dedicated	Future Intercity Network Switched
Gov State Univ	-	-	2 Channel ITFS Microwave	
SIUC	Data: Bitnet/Champg 2 Ckts Spfld 1 Ckt SIUE 1 Ckt CARTVL' VOICE: 6 Ckts CARTVL	- 75B PABX Auto Elec Gandolf Data SW (20) WATS Ckts (4) 800 Ckts (1) FX Marion	1 CKT 9.6 kbs to SI UE	New PABX 100 WATS Ckts
CHIC State Univ	TL-SPFGLFD 5 Ckts Elmhst 1 Ckts Gov State 5 Ckts EDWVL	Centrex ESS	Ckt & MUX (16) Gov State Univ	Digital PBX V/d LAN w/CATV
ILL Emerg SVC	RT Control Ckts: - Marion - Swansea - Clay City - Mechicsbg - Birkbeck - Mazon - Galesburg - Woodridge (3) Oakbrook	(3) 800 WATS	None	None
Dept Revenue	(5) CPX SP/CH (2) OPX SP/RF (2) TL SP/CH	(27) 800 WATS SP (1) Insterstate WATS	(2) TL CH/EG	None
Governors Ofc	None	(2) 800 WATS /CH	None	None
Lt. Governor	None	(2)800WATS /CH-SP	None	None
ILL State Univ	None	GTD 4600 Auto Elec	None	None

Figure C-1

Board Of Governors Col & Univ Edwardsville	Data Ckts: - Sprgfld - Normal - Charlston - Macomb - DeKalb (4) Chicago	CMS CTX	(5) 9.6Kb Ckts E-Mail/Lan	None
NE Ill Univ	None	Rolm/CBX/IFX	None	None
Univ Ill CHGO	TL's/Urbana TL's/Rockford	DMS 100 (12) FX Ckts	(1) T1 vs. Spring	Replace TLs w/800 WATS
Ill State Schls Comm /Deerfield	(1) TL DF/SP (1) TL DF/SOIC	SL 1 (13) Dial Up PC (5) 800 WATS	None	None
Dept Agric/SPF Centralia Galesburg	None None None	CMS/CTX + 800 (1) dial data Ckt key sys	None	GT OMNI DuQuoin
Military & Naval Dept /SPF	None	200 FX Intrastate	None	None
Dept of Mines	CTX/DPX SPF, MARION	CMS/CTX	None	None
Board of Elections	4.8 kb Ckt SPF/CGO	CMS/CTX	9.6 KB SPF/CHGO	(2) 1.2 kb dial ups
Educ Labor Relations	None	CMS/CTX	None	None
Dept of Corr Manteno	None	None	None	None
Dept of Mental Health	(10) TL Elgin/Chgo	CMS/CTX	None	None
LIQ Control Comm	Data Ckts CHGO/ SPF/Leads/State Police	CMS/CTX	None	None
Dept of INSR	Data Ckt SPF/CHGO	CMS/CTX	None	None

Figure C-1

Ill State Police				
- Ashkum	None	CTX OPX	None	(1) 800 Wats
- Bloomington	None	GTE PBX	None	None
- Cairo	None	CTE-PBX	None	(1) 800 WATS New PBX
- Carbondale	None	Key Sys	None	None
- Carmie	None	GTE PBX	None	(1) 800 WATS
- Collinsville	None	Rolm vs CBX	None	(1) 800 WATS
- Chicago	None	Toshiba	None	(1) 800 WATS
- Crestwood	None	AT&T Horiz	None	(1) 800 WATS
- Duquoin	None	GTE	None	(1) 800 WATS
- E. Moline	Sys 36 IBM	AT&T Horiz	None	(1) 800 WATS
- E. Moline	(1) EM/Pecatonica	AT&T Horiz	None	None
- E. Moline	(1) EM/Sterling	AT&T Horiz	None	None
- E. Moline	(1) EM/Bloomington	AT&T Horiz	None	None
- E. Moline	(1) EM/Peoria	AT&T Horiz	None	None
- Effingham	None	NEC-Electra	None	(1) 800 WATS
- Elgin/777	None	AT&T Horiz	None	(1) 800 WATS
- Elgin/595		AT&T Horiz	None	Upgrade Sys
- Elgin/595	2 CKTS CGO/Elgin	(2) FX Elgn/Chgo	CTX-OPX Chgo/Elgin	Upgrade Sys
- Elmhurst	-	CTX	-	-
- Fairview Hts	-	Tie Key	None	Moving Counsil
- Fairview Hts(LAB)	None	None	None	New PBX
- Joliet/Woodruf	None	ROLM CVX	AFIS	New CTX
- Joliet/North	-	ROLM CBX	None	800 WATS
- LaSalle	-	AT&T Horiz	None	800 WATS
- Lincoln	-	2 FX	None	-
- Litchfield	-	Ill Consold	None	800 WATS
- Macomb		GTE PBX	None	800 WATS
- Maywood	-	-	None	New Bldg
- Metamora/Peoria		AT&T Key	None	Upgrade Sys
- Pecatonica	-	ROLM vx CBX	None	800 WATS
- Pesotum	-	OMEGA-FX	None	800 WATS
- Pittsfield	-	GTE PBX FZ/Quinias	None	800 WATS -
- Pontiac	-	Omega	None	800 WATS
- Rockford	None	None	None	New Switch
- Rockford Lab	None	None	New Lab Facilities	- -
- Schaumburg	-	OWN PBX	None	Move PBX Desplains
- Springfield(RT 55)	N/A	Siemans Vista	None	800 WATS
- Springfield (Armory)	N/A	CMS/CTX (5) 800 WATS	None	None
- Sterling	None	Amertec Focus	None	800 WATS
Secty of State	(17) multi Point CKT	CMS/CTX	Upgrade HW	None
Driver Photo	(?) 2.4 Kbs SPF	(2)TL SPF/CHGO	New Concentrator	None
Inquiry/Harris	(11) 2.4 Kbs SPF		Install HDLC	

Figure C-1

No. Ill Univ DeKalb	(2) T1 Data/Sycamore (2) TL Oregon (1) 9.6 kb Edwarsvil (2) 9.5 Kb Argonn Lab -	No Tel SI100 (3) FX Rockford (165) FX Chicago (17) WATS (5) 800 WATS	None	None
Dept Nuclear Safety	(13) P/P LaSalle (7) M/P Reuter Stores (7) P/P Data Link (2) dial up (11) Radio CKTS to tower sites	CMS/CTX	(7) P/P Various Locations	None
Dept Transport	-	CMS/CTX	None	Voice Paging
Board Higher Education	None	None	None	None
Capitol Devil Board	None	None	None	None
Judicial Inq Board	None	None	None	None
Housing Devl Auth	None	None	None	None
Dept Finan Inst	None	None	None	None
Dept on Aging	None	None	None	None
Council Voc Educ	None	None	None	None
State Emp Ret Sys	None	None	None	None
Prop Tax Appeal	None	None	None	None
Legisl Ref Bur	None	None	None	None
Prisn Review Board	None	CTX	None	None
Hist Presv Agn	None	None	None	None

Figure C-1

Lt Gov Ofc Fiscal Asst JJ. Wagoner	None	None	None	None
Atty Genl Ofc	None	None	None	None
DCCA	None	None	None	None
Waukegan Devl	None	SL 1-Med	None	None
Prairie State Games	None	(1) 800 Wats	None	None
Civl Svc Comm	None	None	None	None
Dept Mental Hlt	None	None	None	None
Lands Reclm	None	None	None	None
Treasurers Ofc	(1) Ckt CHGO/ PALOS HGTS	None	None	800 Wats Springfield
Fire Marshal	None	Marion Regnl PBX	None	None
Bur of Budget	None	None	None	None

Figure C-1

ILLINOIS
DEPARTMENT OF
CENTRAL MANAGEMENT SERVICES

Michael E. Tristano, Director

Rose Mary Bombela, Assistant Director

MEMORANDUM

TO: Telecommunications Coordinators

FROM: M. A. Talbott
Communication Services Division

DATE: March 5, 1987

SUBJECT: User Needs Survey

The Department of Central Management Services has initiated the development of a long-range strategic network plan which will address the composite telecommunication needs of State Government. As previously stated in the letter to Agency Directors from Michael E. Tristano, Director of the Department of Central Management Services, dated February 13, 1987, your valued input is essential in gaining a broad prospective of the telecommunications network requirements. The information obtained will provide the consensus of needs and be the basis for plan analysis and development.

One major part of this user needs survey is a survey questionnaire, which each user agency should complete and return to CMS. Although the attached package is weighty, most users should take heart; you should have to fill out only a small portion of the survey.

The survey form is separated into five parts as described below:

- PART 1 requests general user department information, city location, and the name, title, address and phone numbers of a contact person.
- PART 2 requests information about existing DEDICATED intercity facilities and networks for each location.
- PART 3 requests information about existing SWITCHED intercity services and equipment operating in each city.
- PART 4 asks for planning information about future DEDICATED intercity applications and requirements.
- PART 5 asks for planning information about future SWITCHED intercity applications and requirements.

All users should fill out page one of the survey form. If you do not have any dedicated intercity facilities, such as tie-lines, OPX lines, FX lines, or leased data circuits, you can skip Part 2. If you do not plan any of these facilities in the next five years, you can skip Part 4. If you do not have any dial-up data applications or switched voice requirements, such as WATS, direct distance dial (e.g. AT&T or another common carrier's long distance) you can skip Part 3. Future changes to switched requirements should be documented in Part 5. Each part of the survey form has directions and examples.

For those users with large networks, the completion of individual sheets for each component of your network as requested in Part 2 and Part 3, may be substituted with computerized listings or reports providing the required information.

The user needs survey, when completed, will allow those involved in the project to obtain an understanding of existing telecommunications applications, traffic distribution patterns and types of facilities.

Thank you in advance for your time and effort in providing this needed information. Please return the survey forms before March 31, 1987 to Riley Lane at the Department of Central Management Services, Bureau of Information and Communication Services, 700 Stratton Office Building, Springfield, Illinois 62706

Should you have questions about any part of the survey form or directions for completion of the survey, you may contact Riley Lane or myself at 217/782-3600.

MAT:RL:kp
8044c

SURVEY FORM DIRECTIONS

PART 1 GENERAL INFORMATION

The purpose of the statewide telecommunications survey is to collect information about existing and future telecommunications needs and applications for each department and city location in the state. The survey response data, along with other information, will allow NSI to construct a city to city telecommunications traffic matrix and to complete a comprehensive needs assessment analysis.

The general information section of the form requests the name, title, mail address and phone numbers of a primary and secondary contact person as the reference source for gathering the survey information from each user department.

1.1 USER AGENCY OR DEPARTMENT: provide the name of the department that is a user of the state telecommunications systems and providing the survey data responses.

(ie., Department of Agriculture, Division of Administrative Services)

1.2 CITY LOCATION: give the name of the Illinois city where the user department headquarters is located.

(ie., Springfield.State Fairgrounds)

1.3 PRIMARY CONTACT PERSON: give the name, title, mail address, phone and facsimile numbers of the person designated to provide the survey information for all department wide telecommunications usage and requirements.

1.4 ALTERNATE CONTACT PERSON: give the name, title, mail address and phone number of the person designated as the secondary contact in the event the primary contact person is not available. If there is no secondary person designated as backup, then indicate on the form "not available".

PART 2 EXISTING DEDICATED INTERCITY NETWORKS

For the purpose of this survey DEDICATED intercity facilities or networks are considered exclusive telecommunications lines or transmission lines, circuits or channels between two or more cities in Illinois, provided for dedicated use by state agencies.

2.1 NAME OF ORIGINATING CITY: identify the name of the Illinios city where existing dedicated facilities originate and are detailed in this survey. The city where a two -point or multi-point, intra- state dedicated digital data circuit originates or is considered the control point. The city where the primary serving PBX or Centrex equipment for an intercity Tie Line originates.)

If DEDICATED facilities or networks originate from other cities in Illinois a separate survey form should be completed for each city. Users should select one end of all point-to-point lines as the originating point.

2.2 APPLICATION TYPE: provide a brief (two sentence) description of the specific use for the DEDICATED facilities detailed in this section of the survey form.

(ie., - to collect budget data for the office of the director of CMS,
- to transmit payroll time report data to the comptrollers department,
- to make follow-up inquiries on Public Aid, Hospital assistance case work)

If more space is needed to list a number of applications, use the reverse side of this form and note that there is more information listed on reverse side.

2.3 DESTINATION CITY: provide the name of each terminating or destination city with all multipoint networks and dedicated facilities. A separate entry should be prepared for each distant city location to identify the location of the terminations end of circuits.

For each type of dedicated facility existing at your city location provide the following specific information associated with each type of voice arrangement.

- specify the number of dedicated lines or circuits between your city and each destination city location (do not include any intra-city circuits or lines)
- identify the transmission speed or bit rate used for the dedicated lines
- provide your best estimate of the current annual growth rate in terms of percent increase in number of lines for each type of dedicated facility.
- provide the network protocol being used
- identify the provider of those circuits (e.g. AT&T, Illinois Bell Communications, privately owned fiber or microwave)

Note, if any survey response information is provided on documents other than the survey forms, please cross reference the information to the appropriate numerical designated topic area and attach these documents to the survey forms.

PART 3 EXISTING SWITCHED INTERCITY FACILITIES

This part of the survey form follows the other sections in format and type of information to be collected. Again the user department and city location will be the key focal points to ascertain the specifics of traffic distribution patterns and network circuit utilization.

3.3 TYPE OF EXISTING SWITCHED SERVICE

For each city identify all switches with intercity switching capabilities and the specific information about that switch as requested in the survey form sections.

PART 4 FUTURE DEDICATED INTERCITY APPLICATIONS & PART 5 FUTURE SWITCHED INTERCITY APPLICATIONS

This part of the survey again follows the format of questions found in the other sections of the survey. The questions in this section are looking to the future applications and requirements for dedicated intercity network capacity. This information will be melded with the existing dedicated network facility use to obtain a complete picture of intercity traffic distribution requirements in the near future.

2.0 EXISTING DEDICATED INTERCITY NETWORKS

2.1 NAME OF ORIGINATING CITY: (Section 2 should be duplicated for each originating city)

2.2 APPLICATION TYPE:

2.3 NAME OF DESTINATION CITY:

Provide the name of each destination city that is a separate terminating point for dedicated facilities.

3.0 EXISTING SWITCHED INTERCITY FACILITIES

3.1 CITY LOCATION: (Section 3 should be duplicated for each city)

3.2 APPLICATION TYPE:

3.3 TYPE OF EXISTING SWITCHED SERVICE

For each city location identify and provide the following information on a separate page.

3.3.1 Existing leased and owned switch equipment:

- Voice PBX type(analog, digital, manufacturer):
- Date each PBX installed:(contract date)
- Voice Centrex type(#1ESS, #5ESS, etc.)
- Centrex generic level or PBX software level installed:(each centrex)
- Centrex install date:
- Data matrix switch type:
- Public data networks (Telenet, Tymnet, etc.):

3.3.2 inter-city WATS line groups(list for each pbx/centrex location)

- Number inter-state lines:
- Number intra-state lines:
- Number Megacom services or lines:
- Number SDN service lines:

3.3.3 inter-city 800 WATS line groups(list for each pbx/centrex location)
- Number inter-state lines:
- Number intra-state lines:

3.3.4 inter-city FX (foreign exchange) lines

- Identify each city where a FX line is terminated:
- Number terminating at each pbx/centrex location:
- Name of city for each pbx with FX lines:

3.3.5 Data modem pool ports (list for each type pbx/centrex switch)

- Number low speed ports:
- Number 56-64 Kbs ports:
- Number high speed ports:

4.0 FUTURE DEDICATED INTERCITY APPLICATIONS

4.1 NAME OF CITY (Secton 4 should be duplicated for each city)

4.2 APPLICATION TYPE:

4.3 TYPE OF DEDICATED INTERCITY NETWORK FACILITIES REQUIREMENTS

If this is a new application or extensive changes required to an existing system provide the following infomation about this application.

4.3.1 What existing dedicated network or system would the application most likely be associated with in the current state telecommunications environment?
4.3.2 What specifically will the new application be used for?
4.3.3 What type of technology and or transport facilities would be used?
4.3.4 What bandwidth or bit rate per channel will the application require?
4.3.5 List each city in the state that could have a terminating connection point?
4.3.6 Briefly describe anticipated benefits from this application.
4.4.7 What will be the source of new or additional funding?
4.4.8 How much funding will be required annually?
4.4.9 What would the implementation time frame be for the new application?
(1988-1990) (1991-1992) (1993-1995) (beyond 1995)

5.0 FUTURE SWITCHED INTERCITY APPLICATION

5.1 NAME OF CITY (Section 5 should be duplicated for each city):

5.2 TYPE APPLICATION:

5.3 TYPE OF SWITCHED INTERCITY FACILITIES AND SERVICES REQUIREMENTS ASSOCIATED WITH EACH APPLICATION IDENTIFIED

Provide the following information about future SWITCHED service applications.

5.3.1 What existing switched system or network would this application most likely be associated with?
5.3.2 What will the new application be used for?
5.3.3 List the names of cities in illinois which would access this application?
5.3.4 How would switching be accomplished for this application?
5.3.5 How many switched channel, lines or circuits would be required in each city?
5.3.6 What bandwidth or bit rate per channel would be utilized?
5.3.7 What anticipated benefits are associated with this application?
5.3.8 What will be the source of new funding to support the application?
5.3.9 How much additional annual funding will be required for the application?
5.3.10 What is the desired implementation time frame?
(1988-1990) (1991-1992) (1993-95) (beyond 1995)

APPENDIX D

Illinois PBX Systems List

Appendix D — List of Illinois PBX Systems

Appendix D contains a list of Voice PBX switching systems installed for various agencies and departments by a variety of vendors at statewide locations. The list indicates the state agency owning the system, the Illinois city where the PBX is installed, the type of PBX, the PBX manufacturer or vendor, number of station lines currently utilized, and the level of generic software release currently activated on each system. The PBX information was supplied to CMS/BICS by the various Telecommunications and PBX vendors providing service to the state.

LIST OF PBX INSTALLATIONS IN ILLINOIS

Agency	City	PBX#	MANUF	#STA	SW/Release
Law Enfor	Pecatonica	CBX-VS	Rolm	45	5
EPA	Maywood	CBX-S	Rolm	97	4
Elgin Mental	Elgin	CBX-M	Rolm	784	3
DOYouth Ctr	Warrenville	CBX-VS	Rolm	69	4
DORevenue	DesPlaines	CBX-VS	Rolm	44	4
DOFamily Svc	Aurora	CBX-S	Rolm	70	5
Appellate Ct	Elgin	CBX-VS	Rolm	32	5
DOPub. Aid	Granit City	CBX-S	Rolm	96	
DOLaw Enfor	Collinsville	CBX-VS	Rolm	112	
DOEmpc Sec	Alton	CBX-S	Rolm	52	
Anna Mental Hlth	Anna	MCBX	Rolm	229	8001
Centralia Correc.	Centralia	SCBX	Rolm	208	7
DOCorrections	Springfield	MCBX	Rolm	454	5
Dwight Correc Ctr	Dwight	SCBX	Rolm	168	7
Graham Correc	Hillsboro	SCBX	Rolm	186	6
DOPublic Aid	Danville	CBX-VS	Rolm	63	5
So. Ill. Univ.	Carbondale	CBX-S	Rolm	62	6
DO Transportation	Peoria	CBX-VS	Rolm	128	5
Ill Youth Ctr	Joliet	CBX-VS	Rolm	95	5
DOPublic Aid-Hals.	Chicago	CBX-S	Rolm	125	4
DOPublic Aid-Oak	Chicago	CBX-S	Rolm	136	4
DOPublic Aid-Sac	Chicago	CBX-S	Rolm	121	4
DOPublic Aid-Lara.	Chicago	CBX-S	Rolm	160	4
DOLabor-Damen	Chicago	CBX-VS	Rolm	48	4
DOLAW-Joliet	Joliet	CBX-VS	Rolm	56	4
SIL Bureau of ID	Joliet	CBX-VS	Rolm	65	4
SIL Stateville Corr.	Joliet	CBX-M	Rolm	385	7
Public Aid	Aurora	800	AT&T	85	
Corrections	Joliet	400 Dimen	AT&T	337	C
Water Treatment	Rockford	400/2 Dimen	AT&T	180	B
Public Aid	Joliet	400/2Dimen	AT&T	104	C
Regional Office	E.St.Louis	400/2Dimen	AT&T	177	B
Public Aid	Elgin	770A	AT&T	56	
Public Aid	Quincy	756	AT&T	43	
Corrections	Valley View	800A	AT&T	80	

Public Aid	E.St.Louis	770	AT&T	50	
SIU	E.St.Louis	756	AT&T	42	
Public Aid	E.St.Louis	770	AT&T	116	
Public Aid	Midlothian	400Dimen	AT&T	187	B
Ill State Tollway	Oakbrooke	400/Dimen	AT&T	364	C
Public Aid	Villa Park	400/Dimen	AT&T	101	B
Illinois State Youth	Geneva	400/Dimen	AT&T	160	B
Logan Corr.Ctr.	Hanna City	800PBX	AT&T	40	
DOCorrections	East Moline	600/Dimen	AT&T	259	1.3
Public Aid	Chicago	770	AT&T	114	
Child & Fam Svc	Chicago	800	AT&T	52	
Public Aid	Chicago	770	AT&T	175	
Public Aid	Chicago	770A	AT&T	158	
Public Aid	Chicago	770	AT&T	120	
Public Aid	Chicago	770A	AT&T	165	
Public Aid	Chicago	770A	AT&T	232	
Public Aid	Chicago	770A	AT&T	160	
Public Aid	Chicago	770	AT&T	156	
Public Aid	Chicago	770	AT&T	155	
Public Aid	Chicago	770	AT&T	143	
Public Aid	Chicago	770	AT&T	130	
Mental Health	Peoria	400/Dimen	AT&T	331	FP2
Mental Health	Centralia	701	AT&T	121	
Corrections	Vandalia	801	AT&T	135	
Mental Heatlh	Alton	701	AT&T		
DO Labor	Lombard	32A Horiz	AT&T	60	
DO Labor	Belleville	32A Horiz	AT&T	60	
DO Labor	Granite City	32A Horiz	AT&T	60	
DO Labor	Joliet	32A Horiz	AT&T	60	
DO Chil & Fam	Decatur	32A Horiz	AT&T	60	
DO Nuclear Safety	Springfield	32A Horiz	AT&T	60	
DO Lottery	Springfield	32A Horiz	AT&T	60	
DO State Police	E.Moline	32A Horiz	AT&T	60	
DO Public Aid	Chicago	32A Horiz	AT&T	60	
DO Public Aid	Chicago	32A Horiz	AT&T	60	
DO Public Aid	Chicago	32A Horiz	AT&T	60	
DO Labor	Chicago	32A Horiz	AT&T	60	
DO Labor	Chicago	32A Horiz	AT&T	60	
DO Labor	Evanston	32A Horiz	AT&T	60	
DOChild & Fam	Harvey	32A Horiz	AT&T	60	
Boardof Governers	Elmhurst	32A Horiz	AT&T	60	

DOLabor	Waukegan	32A Horiz	AT&T	60	
DO Child & Fam	Lake Villa	16A Horiz	AT&T	40	
Supreme Court	Chicago	16A Horiz	AT&T	40	
DO Public Aid	Ottowa	16A Horiz	AT&T	40	
DO State Police	LaSalle	16A Horiz	AT&T	40	
Dixon Correc. Ctr	Dixon	Sl-IMS	No.Tele	533	711 4.21
DOChild & Fam	Chicago	SD-192MX	Siemans	117	D300
IL State Scholarship	Deerfield	SL-1MS	No. Tele	349	711
IL E.P.A.	Elk Grove	2464Encore	Executone	23	1.6
IL DOChildren	Quincy	1448	Gateway	30	
IL DOTransportat	Carbondale	Vista II	Executone	135	
DOPolice Training	Springfield	Vista II	Executone	111	D300-GS7
DOPublic Health	Edwardsville	Prodigy	Ericson	62	V3
DOPublic Aid	Pekin	Prodigy	Ericson	51	V3
Jacksonville Correc	Jacksonville	SL1-MS	No. Tele	144	7
Lincoln Correc Ctr	Lincoln	SL1-MS	No. Tele	187	5
Danville Correc	Danville	SL1-MS	No. Tele	205	4
Waukegan Develop	Waukegan	SL1-MS	No. Tele	233	4
DOChild & Fam	Springfield	SL1-N	No. Tele	20	4
Marion Regional	Marion	SL1-MS	No. Tele	261	5
Vienna Correc Ctr	Vienna	SL1-MS	No. Tele	396	5
Shawnee Correc Ctr	Vienna	SL1-N	No. Tele	164	4
Galesburg Correc	Galesburg	NEAX2400	NEC	224	2001
DO Public Aid	Chicago	Focus elite	Fujitsu	156	B1
DO Child & Fami	Lombard	SX-100	Mitel	34	216
No East Ill Univ	Chicago	Discovery I	OKI Elec	81	C
DOTransportation	Paris	SX200	Mitel	142	205
Hill Correc Ctr	Galesburg	NEAX2400	NEC	200	
DOMental Health	Dixon	Perception	Toshiba	72	A.04
DOTransporatation	Dixon	SD192MX	Siemans	170	G.S.4
DO Tranporation	Ottawa	3100L	ITT Tele	153	B3.1
FOX Develop Ctr	Dwight	3100L	ITT Tele	79	B2.3
Il State Police Dist1	Sterling	Focus Elite		32	B1
Knox County Dept	Galesburg	SD192MX	Siemans	36	GS5
State of Illinois	Rock Island	192MX	Siemans	88	GS-4

APPENDIX E

Data Systems Summary

Appendix E — Data Systems Summary

Appendix E contains a summary of information about various existing data systems collected from personal interviews with representatives of Illinois agencies and departments.

The data systems summary is shown in Figure E - 1 and contains general information about various data systems and agency operations requirements. The column headings reflected in the data systems summary chart are:

- Name of the agency or department
- Type of data system or equipment installed
- Does the application program reside in the CMS central computer?
- Location(s) of any remote computers or controller equipment
- Number of data terminals connected to the system
- Anticipated system growth
- Office automation requirements
- Multiple agency/system interconnectivity requirements
  - name of other agencies requiring interconnectivity
  - type of systems with interconection requirements
  - cities in Illinois where interconnections are required
  - how are the data systems currently interconnected?

ILLINOIS DATA SYSTEMS

DATA SYSTEM Agency	Primary System Equipment	CMS Resident	Remote Host Equipment & Location	Number of Terminals	System Growth	Office Automation	Interconnectivity with Other Agencies			
							Other Agency	Type System	Where Located	How Connected
CMS Computer Center Springfield	IBM/SNA (2) 3090 (1) 3084 (1) Amdahl 5880	Yes	Chicago Timeplex Multiplexers (Matrix Data Switch Pending Cutover In Chicago)? (6) T1 to Chicago/7 Link 1's	4247 Springfield 4546 Chicago 3668 Misc.	200 per month 12,000/5yrs	WANGNET going in everywhere	Dept. Empl.Sec. DOT Treasury Comptrollers Martin Marietta	IBM 4341 DEC/VAX	Chicago Chicago Springfield Louisiana St. Louis	3275 FE SNI Gateways Gateways Gateways
CMS/Applications Development	IBM/CMS Springfield	Yes	(2) RJE IBM 3777 Stratton Building	Small number Springfield only	Small Amount	Shared Wang eventually	15% Support: Comptrollers, Revenue, Secty. of State	Controllers 3274 Industrial Commission	Chicago Chicago	IBM 3178
CMS/Network Unit	T1 Network IBM/CMS	Yes	Chicago/Springfield Existing Circuits: (6) T1 - 90 Voice - 40 Data Pending Cutover - 80 data/Ckts/Matrix Switch	250 Ckts between Chicago & Springfield	(1) T1 for DES Chicago Springfield Possible T1's to Collinsville/ Rockford	Shared WANGNET	SOIC CCF DES	(6) T1 (7) Link 1's	Springfield Chicago	Leased Lines -AT&T -US Sprint
Secretary of State SOS/DMV Licence Bureau	Honeywell #66 Computers Texas Instruments 990 CPU's Harris 8170	No No CMS Entry to Honeywell to be FE and not MINI Processors	(14) DPS/8 System (5) Honeywell PC Systems (112) 990 CPUs/Tex Instr (DN8 processors later) (78) 8170 Controllers/Harris (25) 8170 ADPs/Harris (3) PC Systems/Cybernex (82) SER-12 Disk/Molecular	371/ Honeywell EQ 474/Tex Instr 615/Harris 77/Cybernex 179/Molecular	To add DPS/6 Chicago DN8 to replace DPS/6 RFP to replace Harris Equip. +200 EDP Terminals per year Traffic +12% year	Honeywell LAN Ethernet Bridge! EQ To install 2nd LAN to replace Harris Equip. will gateway two LAN's	State Police To CMS IRS Corporations Courts Local Police Univ. Libraries Comptrollers Public Aid	IBM Host/Host LAN/SNA Box Statewide Harris 8170 NCR PC's 7207 Honeywell	Springfield Springfield Springfield Springfield	(3) 4800 Kbs circuits Harris EQ Point-to-Point Ckts 2.4Kb
SOS/State Police	Honeywell SOS System	No	(5) District Offices connected to LEADS(Honeywell Computer)	25	Small	None	State Police LEADS	Harris Terminals		
Illinois State Police - LEADS - TIPS	IBM/SNA (2) 3083 VTAM/TCAM/ Bisync 2770 (To be replaced w/IBM/SNA EQ)	Yes	20 District Offices (2) 3725 Springfield (5) System 36	1500 (90) Honeywell 1500 type terminals	Systems <10% traffic > 10% 5 years New Computer Joliet AFIS Applic. (6) New Sys 36	4 of 20 District Offices Equipped with PC's	400 agencies Largest SOS FBI NLES Ariz. Chicago Police	IBM/Honeywell	Springfield Chicago	(2) 2400 bps lines
Department of Corrections Data Processing Systems 220 W. Washington Springfield	(2) HP 3000 Series 68 Host	Yes	None	131/3178 60/Telex 30/Printers	+800 - 5 yrs Terminals Replace HP/w (2) 4381 IBM Sys New Bldg. 7/87	None	CMS SOS HP	HP Gateway to IBM/SNA HP Terminal	Springfield Sprinfgield Chicago	Gateway

ILLINOIS DATA SYSTEMS (continued)

DATA SYSTEM Agency	Primary System Equipment	CMS Resident	Remote Host Equipment & Location	Number of Terminals	System Growth	Office Automation	Interconnectivity with Other Agencies			
							Other Agency	Type System	Where Located	How Connected
Department of Corrections Voice/Radio Concordia Admn. Bldg. Springfield	Dial Access to CMS/IBM 5520 Springfield	Yes	Changing to System 36 Springfield E. Adams (Ultimately 5520/LL to CMS/DISOS) (13) Ckts w/5520 type terminals	30 Terminals	25-30 Systems 5520/CMS Change to IBM DISOS	Future Electronic Mail on Sys 36	CMS	IBM 5520	Springfield	Dial Access Lines
Attorney General	HP 3000 Sys 70 Springfield	No	HP 3000 Sys 70 Chicago +Micom Stat Mux + 30/HP-PC/IBM Compatible	220 Springfield & Chicago	Continuous Upgrade	HP Desk Manager	Comptrollers	Exchange Payroll Tapes	Springfield Chicago	
Dept. Transportation - Springfield - Central Design	DEC/VAX Sys Dual 8700 VAX Single 8100 IBM CAD/CAM Micro System VAX 785	No No Yes/RJE No No	(9) District OFC IBM 8100 each Dist. linked to CMS Main Fram via 3010 LDM's RJE.IMS Function Dist. Ofc. VAX 785/781 (CAD/CAM Design Appl @ 14.4 Kbs)	160 Locations Micom's 8000 Terminals 14 Multi-Drop Lines @ 9.6Kb	Small New Dist. Ofc Peoria New PBX/CTX	Dial Access OIS-140 WANG	CMS State Police	SNA Gateway 3277 Bisync 3279 SNA LEAD6	CMS/CSD Springfield Springfield Springfield	PDP 11
Dept. Revenue - State Lottery	CDC Springfield	No	CDC (3) Dist. Ofc (Olivetti) (6) Regional Offices Sales Reps w/portable PCs	3258/ CDC Terminals	+5000 Next 2 years	None	Comptrollers CMS	Voice Line Check Warrants on Winners	Springfield	LL
Dept. Public Aid (6) Regional Offices (170) Offices in State (20) Nodes	(2) Sperry 5080 5090 Concurrent Computers @ SNA 3230 (3) 3280 Sys Perkin-Elmer Mod 6212 Local Nixdorf CMU	Yes	(20) Nodes (3) 3274 Concurrent Computers (1) IBM Computer 3081 (Acts as back up for CMS) Springfield: (1) 3725, (8) 3274 Chicago: (3) 5090 (6) 5080 Regions	175 14/4's Chicago 14.4 Kb Largest Network 2000 terminals Concurrent System	Growth in terminals to 225 (1) new Ofc/yr	Springfield headquarters WANGNET 300 Chicago (5) WANG units (Not Linked to Springfield)	Bur of Empl Svcs Metro Health-care Centers Secty. State Comptrollers Credit Bureaus	3725 Timplex MuX T1 7700 NCR/PC	Chicago 2 Chicago 2 Springfield Peoria Carbondale	Leased Lines 2.4Kb
Dept. Employment Security	IBM/CMS 3725 Springfield	Yes	3725 (7) offices Chicago 4341 RJE 4381 Development	1157 13 Region 102 County	None	None	None Runs on CMS Host			
Dept. Public Health - Vital Records - Women & Infant Care	IBM 3270 Dial Polling	Yes	(8) Regional Offices 3270 to CMS 200 Clinics w/PC	75 PCs dial access 1-8 PCs each Clinic	None	CMS WANGNET Chicago Shared Use	None Runs on CMS Host System			

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ILLINOIS DATA SYSTEMS (continued)

DATA SYSTEM Agency	Primary System Equipment	CMS Resident	Remote Host Equipment & Location	Number of Terminals	System Growth	Office Automation	Interconnectivity with Other Agencies			
							Other Agency	Type System	Where Located	How Connected
Dept. Mental Health (2) Networks: - CICS (Harris) (20) locations - CPSS.CASS (8100) 90-100 Communities	IBM 8100 Sprinfield Harris Controllers	Yes	20 Remote Hospitals IBM 8100 at: Sprinfield Rockford Anna	+100 PC Terminals	None	Testing LAN -IBM Token Ring in Springfield E-Mail DISOS w/display writers	Dept of Corrections Conservation Children & Family Svcs Historical Sites	Payroll Payroll Payroll Payroll	Springfield	Thru CMS
Dept. Children & Family Services (5) Division EDP Applications (8) Regions	IBM 8130 RJE 8140 C Springfield	Yes	IBM System 36 Peoria to CMS as 3270 RJE Chicago/Cook County Satellite Offices Sys 36 Auroa	225 Terminals 3274 IBM 3278 Equip. Info CMS Field Ofc. IMS Nomad	Sys 36 in all regions by FY 90	PROFS Sys 36 May Link to WANGNET through PROFS later on	Public Aid CMS State Police	(3) Perkin-Elmer Peronnel Records DB Missing Children Database	Springfield Springfield	
Dept. Commerce and Community Affairs International Offices	IBM/CMS Dial Up Access & Leased Lines 9.6 PC Micro's Stand alone	Yes No	Harris 3274/SNA PC Micros S/A WANG System 30's	58 PC's IBM Dial Up	None	WANG Mailway WANGNET OIS System	Chicago City Public Health Agriculture	SNI Gateway Reliance 3 VTAM International System	Chicago Chicago Springfield	SNI
State Board of Public Education	IBM/CMS Springfield	Yes	3277/78/79 Type Terminals (7) Lines to CMS	78 Dial Access terminals	0	None	CMS			
University Illinois Champaign - Administrative - Research Computer Center	IBM/SNA Chicago Cray-XMP48	No No	IBM/SNA Chicago IBM/SNA Champaign (5) 56 Kb Links other universities and business (Kodak)	1600 terminals Champaign and Chicago	20% terminals growth Cray upgrade annually	Broadband LAN/Sytek NVA	Library System NSF Big 10 Universities Medical School	800 Terminals TCAM Cray Computer Dedicated Voice Lines	25 locations Champaign Chicago	 56/64 Kb Digital Leased Lines Microwave

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APPENDIX F

Network Design Traffic Statistics

APPENDIX F

NETWORK DESIGN TRAFFIC STATISTICS

1.0 TRAFFIC DERIVATIONS FOR VOICE AND DATA SYSTEMS

The information contained within Appendix F defines the procedures used in determining the existing and future traffic levels for the State of Illinois. This information includes discussions of special formulas and assumptions included where pertinent.

The traffic statistics are presented in Bits Per Second (bps) in all exhibits, and represent "peak hour" traffic levels. All traffic statistics represent both incoming and outgoing traffic during the peak hour. This is true for both voice and data traffic. Information for these statistics was gathered on an organizational basis and then broken down by individual counties to place all traffic in a 'state-wide' frame of reference. Estimates were prepared for 2 year and 5 year growth scenarios, based upon estimated growth projections provided by State personnel.

The traffic statistics are based upon information gathered from the following sources:

<u>VOICE:</u>

- Carbondale Centrex
- Chicago Centrex
- Elgin Dept. of Mental Health
- Marion Centrex
- Peoria D,P,Q Systems (3 Centrex Systems)
- Rockford Centrex
- Schaumburg Centrex
- Springfield Centrex
- State of Illinois Center in Chicago
- University of Illinois, Champaign Campus
- University of Illinois, Chicago Campus

<u>DATA:</u>

- Central Management Services
- Public Aid
- State Lottery
- State Police

These sources comprise the major traffic sources within the state. Minor sources of traffic were factored into the modeling procedure as background traffic, and are not separately discussed in Appendix F.

2.0 VOICE TRAFFIC

The traffic statistics for voice are based upon total minutes of call time. This information was presented to us in hardcopy print format, detailing the calling patterns of the State organizations listed previously for a period of approximately 1 month. Each form listed 1) Originating Location, 2) Call Destination Areas, 3) Total Minutes, and, 4) Total Number of Attempts. To calculate the actual number of bits/second during peak hours, we employed the following algorithm:

- Divide the total number of minutes (for each destination) by 21, to determine the average number of call minutes per day (assuming an average of 21 work days/month),

- Multiply the daily average call minutes per day by .2 (industry standards recognize 20% as the average amount of daily occuring traffic during the peak hour). This results in the number of call minutes of traffic during the peak hour,

- Multiply the number of call minutes per peak hour by 60, to calculate the amount of call seconds during the peak hour,

- Multiply the call seconds per peak hour by 64,000 (64,000 is the number of bits generated by one second of a digitized vouce conversation) to derive bits per peak hour,

- Divide the bits per peak hour by 3600 to give us bits per second in the peak hour.

The algorithm can be expressed by the following equation (where M = total minutes):

$$\frac{\left(\frac{M}{21\ \text{days}}\right) \times .2\ \text{days} \times 60\ \text{sec.} \times \frac{64{,}000\ \text{bits}}{\text{sec}}}{3600\ \text{sec}} = \text{bps}$$

The voice traffic is represented in Exhibits F-1 through F-11.

3.0 DATA TRAFFIC

The statistics for data traffic were based upon hardcopy traffic listings provided by the organizations previously listed. The data traffic is represented in Exhibits F-12 through F-15. The combined voice and data traffic is shown in Exhibit F-16.

3.1 CENTRAL MANAGEMENT SERVICES

We were provided with a hardcopy listing detailing each CMS line, and the city location of each drop. For each drop, we were provided the number of terminals, and the total number of bytes recieved and transmitted during a 20 minute period during the peak hour. From these figures, we were able to calculate the average Bits Per Second (bps) per terminal, during the peak hour. To relate the terminal city location to a county location, we linked each city location with the appropriate county, and summed all terminals on a county-wide basis. This average bits per second per terminal (45 bps) was then multiplied by the number of terminals for each county, producing a total bps for each county. For complete traffic statistics, see Exhibit F-12.

3.2 PUBLIC AID

For Public Aid, we were given a total number of transactions per month (3.2million). This figure was then divided by 21 days per month to produce the number of transactions per day. The number of transactions per day was then multiplied by .2days per peak hour, and then divided by 3600 seconds per hour to calculate the number of transactions per second (8.5) during the peak hour. Using an industry standard of 1000 characters per transaction, we calculated the number of Bits Per Second (bps) for Public Aid on a state-wide basis. Using this number to represent state-wide traffic for the entire state population, we were able to estimate the amount of traffic per each county, based upon individual county population. For complete traffic statistics, see Exhibit F-13.

3.3 STATE LOTTERY

Lottery provided us with an estimated state-wide number of transactions during the peak hour (1million), and the number of on-line terminals per county. Based upon our discussions with Lottery personnel, we estimated the average transaction length to be approximately 50 characters. From this information, we calculated that each terminal transmits at a rate of approximately 34 bps during the peak hour. The peak hour for Lottery is in the early evening, as opposed to the industry average around mid-day. By multiplying the number of terminals per county with the average bps, we calculated the total bps per county. For complete traffic statistics, see Exhibit F-14.

3.4 STATE POLICE

The Department of State Police provided a hardcopy listing of all lines, and associated drops, and indicated that approximately 80% of all drops were single devices (ie., 3270 PCs). The location of each drop was in city format, which we converted to county format, totalling the number of drops per county. Police personnel also provided the number of transactions per drop and the total number of bytes transmitted per drop during peak hour. By taking the average bytes per transaction (transactions per drop divided by bytes transmitted during peak hour = 215) and multiplying by the average transactions per hour (total number of drops divided by total number of transactions = 159) we derive the number of bytes transmitted per hour per drop. To reduce this number from bytes to bits, this number is then multiplied by 8 (8 bits per byte). To reduce the number from hours to seconds, we divided by 3600 (3600 seconds per hour) leaving an average 76 Bits Per Second (bps) per drop. The total bps per county is calculated by multiplying the bps per drop by the number of drops per county. For complete traffic statistics, see Exhibit F-15.

4.0 TRAFFIC GROWTH PROJECTIONS

Network traffic projections were prepared for 2 year and 5 year growth scenarios. All voice traffic estimates were based upon a growth factor of 5% per year. Projections for data generated by Central Management Services were based upon a growth projection of 250 additional devices per month. State Lottery projections were based upon attaining a 15,000 on-line terminal base within 5 years (growing at a steady rate from the current 3800 terminals). State Police and Public Aid projections were based upon an anticipated growth factor of approximately 30% per year. The 2 and 5 year projections are detailed in Exhibit F-17.

	SOURCE OF TRAFFIC——>	CARBONDALE FOX, JACKSON COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	0	0	0	0
2	ALEXANDER	0	0	0	0
3	BOND	0	0	0	0
4	BOONE	0	0	0	0
5	BROWN	0	0	0	0
6	BUREAU	0	0	0	0
7	CALHOUN	0	0	0	0
8	CARROLL	0	0	0	0
9	CASS	0	0	0	0
10	CHAMPAIGN	0	0	0	0
11	CHRISTIAN	0	0	0	0
12	CLARK	0	0	0	0
13	CLAY	0	0	0	0
14	CLINTON	0	0	0	0
15	COLES	0	0	0	0
16	COOK	3,402	15,243	1,944	34,560
17	CRAWFORD	0	0	0	0
18	CUMBERLAND	0	0	0	0
19	DEKALB	0	0	0	0
20	DEWITT	0	0	0	0
21	DOUGLAS	0	0	0	0
22	DUPAGE	0	0	0	0
23	EDGAR	0	0	0	0
24	EDWARDS	0	0	0	0
25	EFFINGHAM	0	0	0	0
26	FAYETTE	0	0	0	0
27	FORD	0	0	0	0
28	FRANKLIN	0	0	0	0
29	FULTON	0	0	0	0
30	GALLATIN	0	0	0	0
31	GREENE	0	0	0	0
32	GRUNDY	0	0	0	0
33	HAMILTON	0	0	0	0
34	HANCOCK	0	0	0	0
35	HARDIN	0	0	0	0
36	HENDERSON	0	0	0	0
37	HENRY	0	0	0	0
38	IROQUOIS	0	0	0	0
39	JACKSON	0	0	0	0
40	JASPER	0	0	0	0
41	JEFFERSON	0	0	0	0
42	JERSEY	0	0	0	0
43	JODAVIESS	0	0	0	0
44	JOHNSON	0	0	0	0
45	KANE	0	0	0	0
46	KANKAKEE	0	0	0	0
47	KENDALL	0	0	0	0
48	KNOX	0	0	0	0
49	LAKE	0	0	0	0
50	LASALLE	0	0	0	0
51	LAWRENCE	0	0	0	0
52	LEE	0	0	0	0
53	LIVINGSTON	0	0	0	0
54	LOGAN	0	0	0	0
55	MACON	0	0	0	0
56	MACOUPIN	0	0	0	0
57	MADISON	8,780	30,628	5,017.143	89,194
58	MARION	0	0	0	0
59	MARSHALL	0	0	0	0
60	MASON	0	0	0	0
61	MASSAC	0	0	0	0
62	MCDONOUGH	0	0	0	0
63	MCHENRY	0	0	0	0
64	MCLEAN	0	0	0	0
65	MENARD	0	0	0	0
66	MERCER	0	0	0	0
67	MONROE	0	0	0	0
68	MONTGOMERY	0	0	0	0
69	MORGAN	0	0	0	0
70	MOULTRIE	0	0	0	0
71	OGLE	0	0	0	0
72	PEORIA	618	2,695	353.143	6,278
73	PERRY	0	0	0	0
74	PIATT	0	0	0	0
75	PIKE	0	0	0	0
76	POPE	0	0	0	0
77	PULASKI	0	0	0	0
78	PUTNAM	0	0	0	0
79	RANDOLPH	0	0	0	0
80	RICHLAND	0	0	0	0
81	ROCKISLAND	0	0	0	0
82	SALINE	0	0	0	0
83	SANGAMON	3,044	13,871	1,739.429	30,923
84	SCHUYLER	0	0	0	0
85	SCOTT	0	0	0	0
86	SHELBY	0	0	0	0
87	STARK	0	0	0	0
88	SAINTCLAIR	0	0	0	0
89	STEPHENSON	0	0	0	0
90	TAZEWELL	0	0	0	0
91	UNION	0	0	0	0
92	VERMILION	0	0	0	0
93	WABASH	0	0	0	0
94	WARREN	0	0	0	0
95	WASHINGTON	0	0	0	0
96	WAYNE	0	0	0	0
97	WHITE	0	0	0	0
98	WHITESIDE	0	0	0	0
99	WILL	0	0	0	0
100	WILLIAMSON	0	0	0	0
101	WINNEBAGO	439	2,127	250.857	4,460
102	WOODFORD	0	0	0	0
	TOTALS	16,283	64,564	9,304.572	165,415

Exhibit F-1

	SOURCE OF TRAFFIC ---->	CHICAGO CENTREX, COOK COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	2,989	392	1,708	30,364
2	ALEXANDER	101	28	57.714	1,026
3	BOND	64	22	36.571	650
4	BOONE	792	186	452.571	8,046
5	BROWN	26	11	14.857	264
6	BUREAU	598	126	341.714	6,075
7	CALHOUN	29	8	16.571	295
8	CARROLL	1,168	339	667.429	11,865
9	CASS	43	15	24.571	437
10	CHAMPAIGN	10,545	2,596	6,025.714	107,124
11	CHRISTIAN	258	56	147.429	2,621
12	CLARK	71	24	40.571	721
13	CLAY	40	8	22.857	406
14	CLINTON	37	8	21.143	376
15	COLES	1,643	323	938.857	16,691
16	COOK	217,007	63,911	124,004	0
17	CRAWFORD	50	12	28.571	508
18	CUMBERLAND	25	10	14.286	254
19	DEKALB	6,184	1,470	3,533.714	62,822
20	DEWITT	20	7	11.429	203
21	DOUGLAS	119	39	68	1,209
22	DUPAGE	50,837	14,849	29,049.714	516,439
23	EDGAR	108	39	61.714	1,097
24	EDWARDS	9	7	5.143	91
25	EFFINGHAM	292	88	166.857	2,966
26	FAYETTE	119	32	68	1,209
27	FORD	161	40	92	1,636
28	FRANKLIN	211	30	120.571	2,143
29	FULTON	381	121	217.714	3,870
30	GALLATIN	25	3	14.286	254
31	GREENE	110	29	62.857	1,117
32	GRUNDY	798	156	456	8,107
33	HAMILTON	11	2	6.286	112
34	HANCOCK	101	39	57.714	1,026
35	HARDIN	33	5	18.857	335
36	HENDERSON	17	6	9.714	173
37	HENRY	295	83	168.571	2,997
38	IROQUOIS	699	130	399.429	7,101
39	JACKSON	3,381	593	1,932	34,347
40	JASPER	56	11	32	569
41	JEFFERSON	1,559	273	890.857	15,837
42	JERSEY	62	10	35.429	630
43	JODAVIESS	318	105	181.714	3,230
44	JOHNSON	39	15	22.286	396
45	KANE	11,780	3,323	6,731.429	119,670
46	KANKAKEE	4,824	1,331	2,756.571	49,006
47	KENDALL	728	276	416	7,396
48	KNOX	2,608	462	1,490.286	26,494
49	LAKE	10,966	3,382	6,266.286	111,401
50	LASALLE	2,596	500	1,483.429	26,372
51	LAWRENCE	99	19	56.571	1,006
52	LEE	2,426	692	1,386.286	24,645
53	LIVINGSTON	594	164	339.429	6,034
54	LOGAN	769	172	439.429	7,812
55	MACON	2,166	694	1,237.714	22,004
56	MACOUPIN	357	71	204	3,627
57	MADISON	2,229	488	1,273.714	22,644
58	MARION	493	106	281.714	5,008
59	MARSHALL	142	33	81.143	1,443
60	MASON	102	27	58.286	1,036
61	MASSAC	18	5	10.286	183
62	MCDONOUGH	1,705	244	974.286	17,321
63	MCHENRY	5,804	1,531	3,316.571	58,961
64	MCLEAN	1,902	425	1,086.857	19,322
65	MENARD	266	48	152	2,702
66	MERCER	45	17	25.714	457
67	MONROE	65	9	37.143	660
68	MONTGOMERY	521	99	297.714	5,293
69	MORGAN	1,863	467	1,064.571	18,926
70	MOULTRIE	31	13	17.714	315
71	OGLE	1,369	438	782.286	13,907
72	PEORIA	7,244	1,861	4,139.429	73,590
73	PERRY	140	28	80	1,422
74	PIATT	84	31	48	853
75	PIKE	129	19	73.714	1,310
76	POPE	2	2	1.143	20
77	PULASKI	66	13	37.714	670
78	PUTNAM	40	14	22.857	406
79	RANDOLPH	998	164	570.286	10,138
80	RICHLAND	333	51	190.286	3,383
81	ROCKISLAND	3,596	834	2,054.857	36,531
82	SALINE	524	70	299.429	5,323
83	SANGAMON	40,358	10,040	23,061.714	409,986
84	SCHUYLER	48	12	27.429	488
85	SCOTT	30	12	17.143	305
86	SHELBY	117	24	66.857	1,189
87	STARK	127	12	72.571	1,290
88	SAINTCLAIR	3,016	679	1,723.429	30,639
89	STEPHENSON	898	233	513.143	9,123
90	TAZEWELL	1,129	233	645.143	11,469
91	UNION	296	52	169.143	3,007
92	VERMILION	1,987	600	1,135.429	20,185
93	WABASH	69	11	39.429	701
94	WARREN	138	34	78.857	1,402
95	WASHINGTON	67	18	38.286	681
96	WAYNE	52	18	29.714	528
97	WHITE	19	5	10.857	193
98	WHITESIDE	2,142	594	1,224	21,760
99	WILL	5,149	1,474	2,942.286	52,307
100	WILLIAMSON	1,331	235	760.571	13,521
101	WINNEBAGO	9,132	2,426	5,218.286	92,770
102	WOODFORD	234	62	133.714	2,377
	TOTALS	437,394	121,154	249,939.427	2,238,851

Exhibit F-2

	SOURCE OF TRAFFIC——>	ELGIN DEPT. OF MENTAL HEALTH PBX, KANE COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	15	1	8.571	152
2	ALEXANDER	0	0	0	0
3	BOND	0	0	0	0
4	BOONE	31	14	17.714	315
5	BROWN	0	0	0	0
6	BUREAU	2	1	1.143	20
7	CALHOUN	0	0	0	0
8	CARROLL	0	0	0	0
9	CASS	0	0	0	0
10	CHAMPAIGN	56	15	32	569
11	CHRISTIAN	0	0	0	0
12	CLARK	0	0	0	0
13	CLAY	0	0	0	0
14	CLINTON	0	0	0	0
15	COLES	0	0	0	0
16	COOK	24,070	6,857	13,754.286	244,521
17	CRAWFORD	0	0	0	0
18	CUMBERLAND	0	0	0	0
19	DEKALB	304	130	173.714	3,088
20	DEWITT	0	0	0	0
21	DOUGLAS	0	0	0	0
22	DUPAGE	11,259	3,144	6,433.714	114,377
23	EDGAR	0	0	0	0
24	EDWARDS	0	0	0	0
25	EFFINGHAM	23	4	13.143	234
26	FAYETTE	0	0	0	0
27	FORD	0	0	0	0
28	FRANKLIN	0	0	0	0
29	FULTON	0	0	0	0
30	GALLATIN	12	6	6.857	122
31	GREENE	0	0	0	0
32	GRUNDY	1	1	0.571	10
33	HAMILTON	0	0	0	0
34	HANCOCK	2	1	1.143	20
35	HARDIN	0	0	0	0
36	HENDERSON	0	0	0	0
37	HENRY	3	1	1.714	30
38	IROQUOIS	25	3	14.286	254
39	JACKSON	37	12	21.143	376
40	JASPER	0	0	0	0
41	JEFFERSON	0	0	0	0
42	JERSEY	0	0	0	0
43	JODAVIESS	17	4	9.714	173
44	JOHNSON	0	0	0	0
45	KANE	46,870	15,974	26,782.857	0
46	KANKAKEE	724	163	413.714	7,355
47	KENDALL	105	23	60	1,067
48	KNOX	70	0	40	711
49	LAKE	2,874	901	1,642.286	29,196
50	LASALLE	166	28	94.857	1,686
51	LAWRENCE	0	0	0	0
52	LEE	13	6	7.429	132
53	LIVINGSTON	18	3	10.286	183
54	LOGAN	50	11	28.571	508
55	MACON	51	15	29.143	518
56	MACOUPIN	0	0	0	0
57	MADISON	0	0	0	0
58	MARION	0	0	0	0
59	MARSHALL	0	0	0	0
60	MASON	0	0	0	0
61	MASSAC	0	0	0	0
62	MCDONOUGH	0	0	0	0
63	MCHENRY	1,875	580	1,071.429	19,048
64	MCLEAN	23	7	13.143	234
65	MENARD	0	0	0	0
66	MERCER	0	0	0	0
67	MONROE	0	0	0	0
68	MONTGOMERY	0	0	0	0
69	MORGAN	356	59	203.429	3,617
70	MOULTRIE	0	0	0	0
71	OGLE	0	0	0	0
72	PEORIA	15	3	8.571	132
73	PERRY	0	1	0	0
74	PIATT	0	0	0	0
75	PIKE	0	0	0	0
76	POPE	0	0	0	0
77	PULASKI	0	0	0	0
78	PUTNAM	0	0	0	0
79	RANDOLPH	97	19	55.429	985
80	RICHLAND	0	0	0	0
81	ROCKISLAND	8	2	4.571	81
82	SALINE	5	1	2.857	51
83	SANGAMON	2,729	596	1,559.429	27,723
84	SCHUYLER	0	0	0	0
85	SCOTT	0	0	0	0
86	SHELBY	0	0	0	0
87	STARK	0	0	0	0
88	SAINTCLAIR	49	4	28	498
89	STEPHENSON	3	2	1.714	30
90	TAZEWELL	0	0	0	0
91	UNION	2	3	1.143	20
92	VERMILION	8	1	4.571	81
93	WABASH	0	0	0	0
94	WARREN	0	0	0	0
95	WASHINGTON	0	0	0	0
96	WAYNE	0	0	0	0
97	WHITE	0	0	0	0
98	WHITESIDE	13	2	7.429	132
99	WILL	275	62	157.143	2,794
100	WILLIAMSON	0	0	0	0
101	WINNEBAGO	295	100	168.571	2,997
102	WOODFORD	0	0	0	0
	TOTALS	92,551	28,768	52,886.285	464,060

Exhibit F-3

	SOURCE OF TRAFFIC——>	MARION PBX, WILLIAMSON COUNTY			
	DESTINATION	MIN	ATTEMPTS	SEC/PEAK	BPS/PEAK
1	ADAMS	9	323	5.143	91
2	ALEXANDER	1,075	381	614.286	10,921
3	BOND	52	24	29.714	528
4	BOONE	0	0	0	0
5	BROWN	14	15	8	142
6	BUREAU	0	0	0	0
7	CALHOUN	2	4	1.143	20
8	CARROLL	0	0	0	0
9	CASS	24	5	13.714	244
10	CHAMPAIGN	481	120	274.857	4,886
11	CHRISTIAN	28	16	16	284
12	CLARK	4	1	2.286	41
13	CLAY	198	60	113.143	2,011
14	CLINTON	174	50	99.429	1,768
15	COLES	153	28	87.429	1,554
16	COOK	1,133	340	647.429	11,510
17	CRAWFORD	152	50	86.857	1,544
18	CUMBERLAND	6	1	3.429	61
19	DEKALB	27	3	15.429	274
20	DEWITT	0	0	0	0
21	DOUGLAS	4	3	2.286	41
22	DUPAGE	155	38	88.571	1,575
23	EDGAR	21	5	12	213
24	EDWARDS	55	19	31.429	559
25	EFFINGHAM	499	143	285.143	5,069
26	FAYETTE	249	99	142.286	2,530
27	FORD	11	7	6.286	112
28	FRANKLIN	2,072	1,062	1,184	21,049
29	FULTON	140	14	80	1,422
30	GALLATIN	92	68	52.571	935
31	GREENE	17	2	9.714	173
32	GRUNDY	0	0	0	0
33	HAMILTON	144	81	82.286	1,463
34	HANCOCK	2	2	1.143	20
35	HARDIN	93	65	53.143	945
36	HENDERSON	0	0	0	0
37	HENRY	0	0	0	0
38	IROQUOIS	8	5	4.571	81
39	JACKSON	6,104	2,433	3,488	62,009
40	JASPER	164	21	93.714	1,666
41	JEFFERSON	2,277	1,175	1,301.143	23,131
42	JERSEY	2	2	1.143	20
43	JODAVIESS	23	16	13.143	234
44	JOHNSON	800	423	457.143	8,127
45	KANE	94	36	53.714	955
46	KANKAKEE	7	1	4	71
47	KENDALL	0	0	0	0
48	KNOX	31	28	17.714	315
49	LAKE	57	19	32.571	579
50	LASALLE	115	10	65.714	1,168
51	LAWRENCE	144	54	82.286	1,463
52	LEE	23	22	13.143	234
53	LIVINGSTON	76	11	43.429	772
54	LOGAN	30	6	17.143	305
55	MACON	110	37	62.857	1,117
56	MACOUPIN	17	15	9.714	173
57	MADISON	1,769	342	1,010.857	17,971
58	MARION	1,443	518	824.571	14,659
59	MARSHALL	17	10	9.714	173
60	MASON	0	0	0	0
61	MASSAC	661	318	377.714	6,715
62	MCDONOUGH	17	3	9.714	173
63	MCHENRY	15	6	8.571	152
64	MCLEAN	83	21	47.429	843
65	MENARD	0	0	0	0
66	MERCER	23	10	13.143	234
67	MONROE	30	8	17.143	305
68	MONTGOMERY	91	12	52	924
69	MORGAN	122	18	69.714	1,239
70	MOULTRIE	38	4	21.714	386
71	OGLE	0	0	0	0
72	PEORIA	109	44	62.286	1,107
73	PERRY	695	257	397.143	7,060
74	PIATT	19	4	10.857	193
75	PIKE	2	4	1.143	20
76	POPE	218	59	124.571	2,215
77	PULASKI	457	166	261.143	4,643
78	PUTNAM	0	0	0	0
79	RANDOLPH	391	212	223.429	3,972
80	RICHLAND	444	129	253.714	4,510
81	ROCKISLAND	49	10	28	498
82	SALINE	2,069	750	1,182.286	21,018
83	SANGAMON	8,300	2,740	4,742.857	84,317
84	SCHUYLER	4	5	2.286	41
85	SCOTT	0	1	0	0
86	SHELBY	0	0	0	0
87	STARK	0	0	0	0
88	SAINTCLAIR	767	219	438.286	7,792
89	STEPHENSON	7	3	4	71
90	TAZEWELL	13	2	7.429	132
91	UNION	688	294	393.143	6,989
92	VERMILION	40	19	22.857	406
93	WABASH	353	103	201.714	3,586
94	WARREN	0	0	0	0
95	WASHINGTON	195	98	111.429	1,981
96	WAYNE	149	82	85.143	1,514
97	WHITE	646	243	369.143	6,563
98	WHITESIDE	0	0	0	0
99	WILL	1,256	568	717.714	12,759
100	WILLIAMSON	11,186	6,165	6,392	0
101	WINNEBAGO	72	18	41.143	731
102	WOODFORD	0	0	0	0
	TOTALS	49,606	20,808	28,346.288	390,297

Exhibit F-4

	SOURCE OF TRAFFIC---->	PEORIA D,P,Q CENTREX, PEORIA COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	196	48	112	1,991
2	ALEXANDER	51	11	29.143	518
3	BOND	0	0	0	0
4	BOONE	14	2	8	142
5	BROWN	0	0	0	0
6	BUREAU	2,724	563	1,556.571	27,672
7	CALHOUN	85	14	48.571	863
8	CARROLL	16	6	9.143	163
9	CASS	71	25	40.571	721
10	CHAMPAIGN	2,956	637	1,689.143	30,029
11	CHRISTIAN	24	20	13.714	244
12	CLARK	0	0	0	0
13	CLAY	10	3	5.714	102
14	CLINTON	0	0	0	0
15	COLES	360	55	205.714	3,657
16	COOK	8,897	2,075	5,084	90,382
17	CRAWFORD	21	8	12	213
18	CUMBERLAND	2	1	1.143	20
19	DEKALB	531	75	303.429	5,394
20	DEWITT	2	2	1.143	20
21	DOUGLAS	137	7	78.286	1,392
22	DUPAGE	1,082	239	618.286	10,992
23	EDGAR	19	9	10.857	193
24	EDWARDS	2	1	1.143	20
25	EFFINGHAM	54	12	30.857	549
26	FAYETTE	33	6	18.857	335
27	FORD	58	25	33.143	589
28	FRANKLIN	32	5	18.286	325
29	FULTON	3,647	749	2,084	37,049
30	GALLATIN	0	0	0	0
31	GREENE	22	4	12.571	223
32	GRUNDY	113	29	64.571	1,148
33	HAMILTON	2	1	1.143	20
34	HANCOCK	202	29	115.429	2,052
35	HARDIN	0	0	0	0
36	HENDERSON	691	108	394.857	7,020
37	HENRY	1,578	333	901.714	16,030
38	IROQUOIS	82	14	46.857	833
39	JACKSON	242	45	138.286	2,458
40	JASPER	51	14	29.143	518
41	JEFFERSON	84	21	48	853
42	JERSEY	48	14	27.429	488
43	JODAVIESS	205	35	117.143	2,083
44	JOHNSON	11	2	6.286	112
45	KANE	817	172	466.857	8,300
46	KANKAKEE	409	67	233.714	4,155
47	KENDALL	210	32	120	2,133
48	KNOX	10,350	2,927	5,914.286	105,143
49	LAKE	183	35	104.571	1,859
50	LASALLE	7,941	1,742	4,537.714	80,670
51	LAWRENCE	12	2	6.857	122
52	LEE	492	92	281.143	4,998
53	LIVINGSTON	1,067	212	609.714	10,839
54	LOGAN	627	143	358.286	6,370
55	MACON	927	231	529.714	9,417
56	MACOUPIN	32	13	18.286	325
57	MADISON	336	51	192	3,413
58	MARION	71	14	40.571	721
59	MARSHALL	1,186	251	677.714	12,048
60	MASON	417	101	238.286	4,236
61	MASSAC	3	1	1.714	30
62	MCDONOUGH	3,124	737	1,785.143	31,736
63	MCHENRY	26	7	14.857	264
64	MCLEAN	4,055	1,217	2,317.143	41,194
65	MENARD	11	6	6.286	112
66	MERCER	478	109	273.143	4,856
67	MONROE	0	0	0	0
68	MONTGOMERY	26	13	14.857	264
69	MORGAN	263	72	150.286	2,672
70	MOULTRIE	37	12	21.143	376
71	OGLE	19	5	10.857	193
72	PEORIA	4,794	1,035	2,739.429	0
73	PERRY	0	0	0	0
74	PIATT	18	7	10.286	183
75	PIKE	16	5	9.143	163
76	POPE	0	0	0	0
77	PULASKI	5	1	2.857	51
78	PUTNAM	272	55	155.429	2,763
79	RANDOLPH	108	21	61.714	1,097
80	RICHLAND	8	3	4.571	81
81	ROCKISLAND	9,712	1,937	5,549.714	98,662
82	SALINE	133	38	76	1,351
83	SANGAMON	26,091	7,353	14,909.143	265,051
84	SCHUYLER	8	2	4.571	81
85	SCOTT	34	5	19.429	345
86	SHELBY	35	7	20	356
87	STARK	1,488	227	850.286	15,116
88	SAINTCLAIR	834	88	476.571	8,472
89	STEPHENSON	2	2	1.143	20
90	TAZEWELL	12,816	2,771	7,323.429	130,194
91	UNION	46	11	26.286	467
92	VERMILION	202	43	115.429	2,052
93	WABASH	0	0	0	0
94	WARREN	2,040	357	1,165.714	20,724
95	WASHINGTON	1	1	0.571	10
96	WAYNE	10	2	5.714	102
97	WHITE	0	0	0	0
98	WHITESIDE	567	101	324	5,760
99	WILL	495	80	282.857	5,029
100	WILLIAMSON	188	44	107.429	1,910
101	WINNEBAGO	2,414	341	1,379.429	24,523
102	WOODFORD	2,702	517	1,544	27,449
	TOTALS	122,513	28,565	70,007.429	1,195,871

Exhibit F-5

	SOURCE OF TRAFFIC---->	ROCKFORD CENTREX, WINNEBAGO COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	59	9	33.714	599
2	ALEXANDER	0	0	0	0
3	BOND	2	1	1.143	20
4	BOONE	35	12	20	356
5	BROWN	0	0	0	0
6	BUREAU	155	32	88.571	1,575
7	CALHOUN	1	1	0.571	10
8	CARROLL	1,168	235	667.429	11,865
9	CASS	2	1	1.143	20
10	CHAMPAIGN	3,431	263	1,960.571	34,855
11	CHRISTIAN	21	5	12	213
12	CLARK	0	0	0	0
13	CLAY	0	0	0	0
14	CLINTON	5	2	2.857	51
15	COLES	15	6	8.571	152
16	COOK	11,293	2,680	6,453.143	114,723
17	CRAWFORD	0	0	0	0
18	CUMBERLAND	0	0	0	0
19	DEKALB	3,205	762	1,831.429	32,559
20	DEWITT	0	0	0	0
21	DOUGLAS	0	0	0	0
22	DUPAGE	2,295	486	1,311.429	23,314
23	EDGAR	0	0	0	0
24	EDWARDS	0	0	0	0
25	EFFINGHAM	2	1	1.143	20
26	FAYETTE	35	10	20	356
27	FORD	2	2	1.143	20
28	FRANKLIN	0	0	0	0
29	FULTON	28	10	16	284
30	GALLATIN	7	1	4	71
31	GREENE	17	6	9.714	173
32	GRUNDY	182	47	104	1,849
33	HAMILTON	0	0	0	0
34	HANCOCK	4	1	2.286	41
35	HARDIN	0	0	0	0
36	HENDERSON	7	2	4	71
37	HENRY	150	18	85.714	1,524
38	IROQUOIS	15	1	8.571	152
39	JACKSON	329	49	188	3,342
40	JASPER	2	1	1.143	20
41	JEFFERSON	78	13	44.571	792
42	JERSEY	57	6	32.571	579
43	JODAVIESS	1,129	212	645.143	11,469
44	JOHNSON	46	18	26.286	467
45	KANE	2,083	461	1,190.286	21,161
46	KANKAKEE	117	34	66.857	1,189
47	KENDALL	66	23	37.714	670
48	KNOX	511	81	292	5,191
49	LAKE	979	195	559.429	9,945
50	LASALLE	1,262	269	721.143	12,820
51	LAWRENCE	0	0	0	0
52	LEE	5,494	1,376	3,139.429	55,812
53	LIVINGSTON	433	93	247.429	4,399
54	LOGAN	163	50	93.143	1,656
55	MACON	133	36	76	1,351
56	MACOUPIN	12	3	6.857	122
57	MADISON	44	9	25.143	447
58	MARION	169	35	96.571	1,717
59	MARSHALL	20	3	11.429	203
60	MASON	2	1	1.143	20
61	MASSAC	0	0	0	0
62	MCDONOUGH	100	18	57.143	1,016
63	MCHENRY	1,098	262	627.429	11,154
64	MCLEAN	256	59	146.286	2,601
65	MENARD	0	0	0	0
66	MERCER	8	1	4.571	81
67	MONROE	0	0	0	0
68	MONTGOMERY	46	17	26.286	467
69	MORGAN	131	28	74.857	1,331
70	MOULTRIE	0	0	0	0
71	OGLE	1,721	506	983.429	17,483
72	PEORIA	1,210	227	691.429	12,292
73	PERRY	1	1	0.571	10
74	PIATT	14	2	8	142
75	PIKE	16	2	9.143	163
76	POPE	1	1	0.571	10
77	PULASKI	0	0	0	0
78	PUTNAM	2	1	1.143	20
79	RANDOLPH	40	14	22.857	406
80	RICHLAND	1	1	0.571	10
81	ROCKISLAND	1,519	247	868	15,431
82	SALINE	53	11	30.286	538
83	SANGAMON	11,349	2,903	6,485.143	115,291
84	SCHUYLER	0	0	0	0
85	SCOTT	0	0	0	0
86	SHELBY	0	0	0	0
87	STARK	39	6	22.286	396
88	SAINTCLAIR	194	37	110.857	1,971
89	STEPHENSON	5,464	1,419	3,122.286	55,507
90	TAZEWELL	129	16	73.714	1,310
91	UNION	23	5	13.143	234
92	VERMILION	132	28	75.429	1,341
93	WABASH	0	0	0	0
94	WARREN	14	7	8	142
95	WASHINGTON	0	0	0	0
96	WAYNE	2	1	1.143	20
97	WHITE	0	0	0	0
98	WHITESIDE	3,123	632	1,784.571	31,726
99	WILL	1,245	350	711.429	12,648
100	WILLIAMSON	221	17	126.286	2,245
101	WINNEBAGO	1,292	323	738.286	0
102	WOODFORD	35	10	20	356
	TOTALS	64,744	14,714	36,996.574	644,587

Exhibit F-6

	SOURCE OF TRAFFIC---->	SCHAUMBURG PBX, COOK COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	3	1	1.714	30
2	ALEXANDER	0	0	0	0
3	BOND	0	0	0	0
4	BOONE	49	5	28	498
5	BROWN	0	0	0	0
6	BUREAU	26	4	14.857	264
7	CALHOUN	0	0	0	0
8	CARROLL	5	1	2.857	51
9	CASS	0	0	0	0
10	CHAMPAIGN	172	28	98.286	1,747
11	CHRISTIAN	0	0	0	0
12	CLARK	0	0	0	0
13	CLAY	0	0	0	0
14	CLINTON	5	1	2.857	51
15	COLES	8	2	4.571	81
16	COOK	0	0	0	0
17	CRAWFORD	0	0	0	0
18	CUMBERLAND	0	0	0	0
19	DEKALB	105	26	60	1,067
20	DEWITT	0	0	0	0
21	DOUGLAS	0	0	0	0
22	DUPAGE	0	0	0	0
23	EDGAR	29	5	16.571	295
24	EDWARDS	0	0	0	0
25	EFFINGHAM	0	0	0	0
26	FAYETTE	0	0	0	0
27	FORD	0	0	0	0
28	FRANKLIN	0	0	0	0
29	FULTON	0	0	0	0
30	GALLATIN	0	0	0	0
31	GREENE	0	0	0	0
32	GRUNDY	52	8	29.714	528
33	HAMILTON	0	0	0	0
34	HANCOCK	0	0	0	0
35	HARDIN	0	0	0	0
36	HENDERSON	0	0	0	0
37	HENRY	14	4	8	142
38	IROQUOIS	0	0	0	0
39	JACKSON	56	8	32	569
40	JASPER	0	0	0	0
41	JEFFERSON	3	1	1.714	30
42	JERSEY	0	0	0	0
43	JODAVIESS	6	3	3.429	61
44	JOHNSON	0	0	0	0
45	KANE	0	0	0	0
46	KANKAKEE	120	14	68.571	1,219
47	KENDALL	7	2	4	71
48	KNOX	0	0	0	0
49	LAKE	0	0	0	0
50	LASALLE	88	19	50.286	894
51	LAWRENCE	0	0	0	0
52	LEE	190	26	108.571	1,930
53	LIVINGSTON	0	0	0	0
54	LOGAN	17	3	9.714	173
55	MACON	7	2	4	71
56	MACOUPIN	0	0	0	0
57	MADISON	6	2	3.429	61
58	MARION	0	0	0	0
59	MARSHALL	0	0	0	0
60	MASON	20	6	11.429	203
61	MASSAC	0	0	0	0
62	MCDONOUGH	0	0	0	0
63	MCHENRY	281	62	160.571	2,855
64	MCLEAN	13	4	7.429	132
65	MENARD	0	0	0	0
66	MERCER	0	0	0	0
67	MONROE	0	0	0	0
68	MONTGOMERY	0	0	0	0
69	MORGAN	17	3	9.714	173
70	MOULTRIE	2	1	1.143	20
71	OGLE	3	1	1.714	30
72	PEORIA	36	9	20.571	366
73	PERRY	0	0	0	0
74	PIATT	0	0	0	0
75	PIKE	0	0	0	0
76	POPE	0	0	0	0
77	PULASKI	0	0	0	0
78	PUTNAM	0	0	0	0
79	RANDOLPH	0	0	0	0
80	RICHLAND	0	0	0	0
81	ROCKISLAND	169	28	96.571	1,717
82	SALINE	4	1	2.286	41
83	SANGAMON	1,522	304	869.714	15,462
84	SCHUYLER	0	0	0	0
85	SCOTT	0	0	0	0
86	SHELBY	0	0	0	0
87	STARK	0	0	0	0
88	SAINTCLAIR	21	5	12	213
89	STEPHENSON	18	5	10.286	183
90	TAZEWELL	7	2	4	71
91	UNION	0	0	0	0
92	VERMILION	0	0	0	0
93	WABASH	0	0	0	0
94	WARREN	0	0	0	0
95	WASHINGTON	0	0	0	0
96	WAYNE	0	0	0	0
97	WHITE	0	0	0	0
98	WHITESIDE	21	8	12	213
99	WILL	28	5	16	284
100	WILLIAMSON	0	0	0	0
101	WINNEBAGO	138	26	78.857	1,402
102	WOODFORD	0	0	0	0
	TOTALS	3,268	631	1,867.426	33,198

Exhibit F-7

	SOURCE OF TRAFFIC --->	SPRINGFIELD CENTREX, SANGAMON COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	27,748	6,283	15,856	281,884
2	ALEXANDER	2,751	632	1,572	27,947
3	BOND	2,182	530	1,246.857	22,166
4	BOONE	1,956	554	1,117.714	19,870
5	BROWN	195	58	111.429	1,981
6	BUREAU	5,327	1,413	3,044	54,116
7	CALHOUN	1,654	369	945.143	16,803
8	CARROLL	1,782	377	1,018.286	18,103
9	CASS	7,417	1,792	4,238.286	75,347
10	CHAMPAIGN	82,243	19,074	46,996	835,484
11	CHRISTIAN	18,328	5,152	10,473.143	186,189
12	CLARK	1,609	364	919.429	16,345
13	CLAY	2,725	620	1,557.143	27,683
14	CLINTON	5,632	1,199	3,218.286	57,214
15	COLES	15,529	3,956	8,873.714	157,755
16	COOK	1,024,999	249,228	585,713.714	10,412,688
17	CRAWFORD	2,354	538	1,345.143	23,914
18	CUMBERLAND	1,803	472	1,030.286	18,316
19	DEKALB	13,524	2,507	7,728	137,387
20	DEWITT	3,784	1,439	2,162.286	38,441
21	DOUGLAS	3,241	888	1,852	32,924
22	DUPAGE	82,852	22,127	47,344	841,671
23	EDGAR	5,036	1,140	2,877.714	51,159
24	EDWARDS	933	233	533.143	9,478
25	EFFINGHAM	8,470	852	4,840	86,044
26	FAYETTE	7,003	1,674	4,001.714	71,142
27	FORD	2,805	864	1,602.857	28,495
28	FRANKLIN	6,871	1,681	3,926.286	69,801
29	FULTON	7,934	1,890	4,533.714	80,599
30	GALLATIN	698	180	398.857	7,091
31	GREENE	4,203	932	2,401.714	42,697
32	GRUNDY	4,346	1,186	2,483.429	44,150
33	HAMILTON	921	241	526.286	9,356
34	HANCOCK	3,548	875	2,027.429	36,043
35	HARDIN	490	136	280	4,978
36	HENDERSON	873	285	498.857	8,869
37	HENRY	5,985	1,344	3,420	60,800
38	IROQUOIS	6,116	1,919	3,494.857	62,131
39	JACKSON	31,478	7,139	17,987.429	319,777
40	JASPER	1,757	384	1,004	17,849
41	JEFFERSON	22,704	3,484	12,973.714	230,644
42	JERSEY	4,576	1,033	2,614.857	46,486
43	JODAVIESS	3,726	879	2,129.143	37,851
44	JOHNSON	6,120	1,319	3,497.143	62,171
45	KANE	51,889	13,015	29,650.857	527,126
46	KANKAKEE	24,965	5,310	14,265.714	253,613
47	KENDALL	2,962	658	1,692.571	30,090
48	KNOX	35,538	6,836	20,307.429	361,021
49	LAKE	34,069	9,351	19,468	346,098
50	LASALLE	19,146	5,148	10,940.571	194,499
51	LAWRENCE	2,337	539	1,335.429	23,741
52	LEE	9,132	2,238	5,218.286	92,770
53	LIVINGSTON	13,260	3,629	7,577.143	134,705
54	LOGAN	25,939	7,720	14,822.286	263,507
55	MACON	41,895	12,006	23,940	425,600
56	MACOUPIN	21,257	4,878	12,146.857	215,944
57	MADISON	36,830	9,424	21,045.714	374,146
58	MARION	14,988	3,621	8,564.571	152,259
59	MARSHALL	1,761	400	1,006.286	17,890
60	MASON	6,902	1,710	3,944	70,116
61	MASSAC	1,697	400	969.714	17,239
62	MCDONOUGH	10,415	2,614	5,951.429	105,803
63	MCHENRY	11,201	2,778	6,400.571	113,788
64	MCLEAN	41,774	10,223	23,870.857	424,371
65	MENARD	12,681	2,549	7,246.286	128,823
66	MERCER	1,822	418	1,041.143	18,509
67	MONROE	1,639	347	936.571	16,650
68	MONTGOMERY	15,542	4,026	8,881.143	157,887
69	MORGAN	32,425	8,150	18,528.571	329,397
70	MOULTRIE	2,286	693	1,306.286	23,223
71	OGLE	3,726	980	2,129.143	37,851
72	PEORIA	72,618	15,765	41,496	737,707
73	PERRY	3,903	912	2,230.286	39,650
74	PIATT	3,344	852	1,910.857	33,971
75	PIKE	4,871	1,206	2,783.429	49,483
76	POPE	494	140	282.286	5,018
77	PULASKI	1,759	365	1,005.143	17,869
78	PUTNAM	719	182	410.857	7,304
79	RANDOLPH	13,515	3,006	7,722.857	137,295
80	RICHLAND	3,972	898	2,269.714	40,350
81	ROCKISLAND	25,103	6,539	14,344.571	255,015
82	SALINE	7,551	1,516	4,314.857	76,709
83	SANGAMON	17,302	3,809	9,886.857	0
84	SCHUYLER	1,513	464	864.571	15,370
85	SCOTT	2,579	708	1,473.714	26,199
86	SHELBY	4,948	1,138	2,827.429	50,265
87	STARK	611	128	349.143	6,207
88	SAINTCLAIR	97,927	13,393	55,958.286	994,814
89	STEPHENSON	5,960	1,182	3,405.714	60,546
90	TAZEWELL	12,542	3,259	7,166.857	127,411
91	UNION	5,056	1,119	2,889.143	51,363
92	VERMILION	20,613	5,406	11,778.857	209,402
93	WABASH	1,803	409	1,030.286	18,316
94	WARREN	4,398	951	2,513.143	44,678
95	WASHINGTON	2,608	667	1,490.286	26,494
96	WAYNE	1,872	999	1,069.714	19,017
97	WHITE	3,716	653	2,123.429	37,750
98	WHITESIDE	9,429	2,933	5,388	95,787
99	WILL	45,175	11,461	25,814.286	458,921
100	WILLIAMSON	26,667	6,258	15,238.286	270,903
101	WINNEBAGO	50,788	10,452	29,021.714	515,942
102	WOODFORD	3,106	785	1,774.857	31,553
	TOTALS	2,380,768	566,458	1,360,438.859	24,009,814

Exhibit F-8

	SOURCE OF TRAFFIC ——>	STATE OF ILLINOIS CENTER PBX		COOK COUNTY	
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	342	163	195.429	3,474
2	ALEXANDER	54	18	30.857	549
3	BOND	44	27	25.143	447
4	BOONE	220	70	125.714	2,235
5	BROWN	32	13	18.286	325
6	BUREAU	244	71	139.429	2,479
7	CALHOUN	0	0	0	0
8	CARROLL	58	22	33.143	589
9	CASS	163	29	93.143	1,656
10	CHAMPAIGN	4,025	1,240	2,300	40,889
11	CHRISTIAN	265	79	151.429	2,692
12	CLARK	59	26	33.714	599
13	CLAY	29	12	16.571	295
14	CLINTON	42	32	24	427
15	COLES	619	167	353.714	6,288
16	COOK	572,418	270,938	327,096	0
17	CRAWFORD	47	12	26.857	477
18	CUMBERLAND	5	6	2.857	51
19	DEKALB	2,540	692	1,451.429	25,803
20	DEWITT	3	1	1.714	30
21	DOUGLAS	45	23	25.714	457
22	DUPAGE	35,300	15,841	20,171.429	358,603
23	EDGAR	56	25	32	569
24	EDWARDS	9	6	5.143	91
25	EFFINGHAM	102	42	58.286	1,036
26	FAYETTE	175	85	100	1,778
27	FORD	16	13	9.143	163
28	FRANKLIN	63	60	36	640
29	FULTON	310	80	177.143	3,149
30	GALLATIN	184	19	105.143	1,869
31	GREENE	47	14	26.857	477
32	GRUNDY	392	154	224	3,982
33	HAMILTON	3	7	1.714	30
34	HANCOCK	36	16	20.571	366
35	HARDIN	1	1	0.571	10
36	HENDERSON	7	7	4	71
37	HENRY	240	95	137.143	2,438
38	IROQUOIS	221	59	126.286	2,245
39	JACKSON	1,291	458	737.714	13,115
40	JASPER	7	5	4	71
41	JEFFERSON	399	169	228	4,053
42	JERSEY	177	56	101.143	1,798
43	JODAVIESS	224	84	128	2,276
44	JOHNSON	183	84	104.571	1,859
45	KANE	8,580	3,336	4,902.857	87,162
46	KANKAKEE	2,677	966	1,529.714	27,195
47	KENDALL	358	159	204.571	3,637
48	KNOX	894	331	510.857	9,082
49	LAKE	14,167	5,691	8,095.429	143,919
50	LASALLE	1,127	469	644	11,449
51	LAWRENCE	31	8	17.714	315
52	LEE	706	226	403.429	7,172
53	LIVINGSTON	1,061	282	606.286	10,778
54	LOGAN	453	128	258.857	4,602
55	MACON	1,019	346	582.286	10,352
56	MACOUPIN	145	57	82.857	1,473
57	MADISON	1,230	526	702.857	12,495
58	MARION	554	180	316.571	5,628
59	MARSHALL	70	24	40	711
60	MASON	64	17	36.571	650
61	MASSAC	0	0	0	0
62	MCDONOUGH	311	123	177.714	3,159
63	MCHENRY	2,612	972	1,492.571	26,535
64	MCLEAN	2,080	651	1,188.571	21,130
65	MENARD	138	50	78.857	1,402
66	MERCER	122	33	69.714	1,239
67	MONROE	59	8	33.714	599
68	MONTGOMERY	317	84	181.143	3,220
69	MORGAN	1,598	579	913.143	16,234
70	MOULTRIE	56	16	32	569
71	OGLE	519	125	296.571	5,272
72	PEORIA	2,749	1,010	1,570.857	27,926
73	PERRY	15	17	8.571	152
74	PIATT	45	28	25.714	457
75	PIKE	1	11	0.571	10
76	POPE	15	9	8.571	152
77	PULASKI	62	22	35.429	630
78	PUTNAM	16	7	9.143	163
79	RANDOLPH	1,043	272	596	10,596
80	RICHLAND	81	24	46.286	823
81	ROCKISLAND	1,330	1,451	760	13,511
82	SALINE	93	30	53.143	945
83	SANGAMON	168,698	60,102	96,398.857	1,713,757
84	SCHUYLER	3	3	1.714	30
85	SCOTT	8	6	4.571	81
86	SHELBY	40	27	22.857	406
87	STARK	5	3	2.857	51
88	SAINTCLAIR	1,478	510	844.571	15,015
89	STEPHENSON	562	191	321.143	5,709
90	TAZEWELL	403	120	230.286	4,094
91	UNION	113	44	64.571	1,148
92	VERMILION	647	272	369.714	6,573
93	WABASH	51	20	29.143	518
94	WARREN	169	82	96.571	1,717
95	WASHINGTON	84	18	48	853
96	WAYNE	46	14	26.286	467
97	WHITE	105	18	60	1,067
98	WHITESIDE	581	138	332	5,902
99	WILL	6,530	2,454	3,731.429	66,337
100	WILLIAMSON	791	249	452	8,036
101	WINNEBAGO	3,892	1,551	2,224	39,538
102	WOODFORD	109	54	62.286	1,107
	TOTALS	851,410	375,165	486,519.995	2,834,201

Exhibit F-9

	SOURCE OF TRAFFIC——>	U OF ILLINOIS CHAMPAIGN PBX, CHAMPAIGN COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	BPSPEAK
1	ADAMS	852	130	486.857	8,655
2	ALEXANDER	19	8	10.857	193
3	BOND	159	24	90.857	1,615
4	BOONE	777	164	444	7,893
5	BROWN	87	6	49.714	884
6	BUREAU	670	105	382.857	6,806
7	CALHOUN	55	11	31.429	559
8	CARROLL	155	26	88.571	1,575
9	CASS	169	36	96.571	1,717
10	CHAMPAIGN	960	266	548.571	0
11	CHRISTIAN	537	97	306.857	5,455
12	CLARK	356	66	203.429	3,617
13	CLAY	97	16	55.429	985
14	CLINTON	373	56	213.143	3,789
15	COLES	11,022	2,588	6,298.286	111,970
16	COOK	187,354	34,730	107,059.429	1,903,279
17	CRAWFORD	308	49	176	3,129
18	CUMBERLAND	228	43	130.286	2,316
19	DEKALB	9,011	1,512	5,149.143	91,540
20	DEWITT	521	112	297.714	5,293
21	DOUGLAS	4,801	1,506	2,743.429	48,772
22	DUPAGE	56,316	9,742	32,180.571	572,099
23	EDGAR	939	178	536.571	9,539
24	EDWARDS	187	31	106.857	1,900
25	EFFINGHAM	778	170	444.571	7,903
26	FAYETTE	250	42	142.857	2,540
27	FORD	1,899	429	1,085.143	19,291
28	FRANKLIN	347	63	198.286	3,525
29	FULTON	642	122	366.857	6,522
30	GALLATIN	44	10	25.143	447
31	GREENE	326	46	186.286	3,312
32	GRUNDY	522	74	298.286	5,303
33	HAMILTON	136	15	77.714	1,382
34	HANCOCK	234	32	133.714	2,377
35	HARDIN	2	2	1.143	20
36	HENDERSON	65	9	37.143	660
37	HENRY	433	64	247.429	4,399
38	IROQUOIS	2,481	423	1,417.714	25,204
39	JACKSON	7,474	1,578	4,270.857	75,926
40	JASPER	477	49	272.571	4,846
41	JEFFERSON	483	75	276	4,907
42	JERSEY	162	35	92.571	1,646
43	JODAVIESS	213	32	121.714	2,164
44	JOHNSON	415	59	237.143	4,216
45	KANE	11,102	1,993	6,344	112,782
46	KANKAKEE	4,108	872	2,347.429	41,732
47	KENDALL	1,055	260	602.857	10,717
48	KNOX	1,310	225	748.571	13,308
49	LAKE	14,509	2,604	8,290.857	147,393
50	LASALLE	1,579	218	902.286	16,041
51	LAWRENCE	344	44	196.571	3,495
52	LEE	585	98	334.286	5,943
53	LIVINGSTON	1,228	204	701.714	12,475
54	LOGAN	500	101	285.714	5,079
55	MACON	14,960	3,652	8,548.571	151,975
56	MACOUPIN	735	99	420	7,467
57	MADISON	2,971	548	1,697.714	30,182
58	MARION	663	98	378.857	6,735
59	MARSHALL	174	31	99.429	1,768
60	MASON	365	67	208.571	3,708
61	MASSAC	165	21	94.286	1,676
62	MCDONOUGH	1,514	203	865.143	15,380
63	MCHENRY	2,504	424	1,430.857	25,437
64	MCLEAN	23,581	4,610	13,474.857	239,553
65	MENARD	142	27	81.143	1,443
66	MERCER	116	24	66.286	1,178
67	MONROE	286	38	163.429	2,905
68	MONTGOMERY	411	63	234.857	4,175
69	MORGAN	1,739	264	993.714	17,666
70	MOULTRIE	711	147	406.286	7,223
71	OGLE	739	104	422.286	7,507
72	PEORIA	17,476	4,001	9,986.286	177,534
73	PERRY	269	36	153.714	2,733
74	PIATT	6,062	1,522	3,464	61,582
75	PIKE	243	47	138.857	2,469
76	POPE	120	22	68.571	1,219
77	PULASKI	34	10	19.429	345
78	PUTNAM	51	5	29.143	518
79	RANDOLPH	387	47	221.143	3,931
80	RICHLAND	409	58	233.714	4,155
81	ROCKISLAND	4,599	877	2,628	46,720
82	SALINE	355	54	202.857	3,606
83	SANGAMON	44,987	9,509	25,706.857	457,011
84	SCHUYLER	73	10	41.714	742
85	SCOTT	79	16	45.143	803
86	SHELBY	588	154	336	5,973
87	STARK	126	23	72	1,280
88	SAINTCLAIR	3,447	573	1,969.714	35,017
89	STEPHENSON	496	82	283.429	5,039
90	TAZEWELL	1,262	223	721.143	12,820
91	UNION	212	35	121.143	2,154
92	VERMILION	13,130	3,397	7,502.857	133,384
93	WABASH	148	21	84.571	1,503
94	WARREN	180	44	102.857	1,829
95	WASHINGTON	297	32	169.714	3,017
96	WAYNE	85	19	48.571	863
97	WHITE	187	31	106.857	1,900
98	WHITESIDE	725	110	414.286	7,365
99	WILL	8,186	1,581	4,677.714	83,159
100	WILLIAMSON	705	105	402.857	7,162
101	WINNEBAGO	4,908	1,021	2,804.571	49,859
102	WOODFORD	661	116	377.714	6,715
	TOTALS	491,919	95,671	281,096.567	4,987,520

Exhibit F-10

	SOURCE OF TRAFFIC →	U OF ILLINOIS CHICAGO PBX, COOK COUNTY			
	DESTINATION	MIN	ATTEMPTS	SECPERPEAK	DPSPEAK
1	ADAMS	133	43	76	1351
2	ALEXANDER	0	0	0	0
3	BOND	5	3	2.857	51
4	BOONE	312	96	178.286	3170
5	BROWN	0	0	0	0
6	BUREAU	146	39	83.429	1483
7	CALHOUN	19	4	10.857	193
8	CARROLL	34	6	19.429	345
9	CASS	3	2	1.714	30
10	CHAMPAIGN	5039	1246	2879.429	51190
11	CHRISTIAN	28	2	16	284
12	CLARK	2	1	1.143	20
13	CLAY	0	0	0	0
14	CLINTON	2	1	1.143	20
15	COLES	311	71	177.714	3159
16	COOK	225973	67179	129127.429	0
17	CRAWFORD	52	4	29.714	528
18	CUMBERLAND	0	0	0	0
19	DEKALB	1798	413	1027.429	18265
20	DEWITT	0	0	0	0
21	DOUGLAS	16	6	9.143	163
22	DUPAGE	42574	12747	24328	432498
23	EDGAR	5	5	2.857	51
24	EDWARDS	0	0	0	0
25	EFFINGHAM	33	8	18.857	335
26	FAYETTE	0	0	0	0
27	FORD	58	15	33.143	589
28	FRANKLIN	38	2	21.714	386
29	FULTON	12	5	6.857	122
30	GALLATIN	10	1	5.714	102
31	GREENE	3	2	1.714	30
32	GRUNDY	295	50	168.571	2997
33	HAMILTON	0	0	0	0
34	HANCOCK	9	3	5.143	91
35	HARDIN	0	0	0	0
36	HENDERSON	9	4	5.143	91
37	HENRY	99	15	56.571	1006
38	IROQUOIS	69	19	39.429	701
39	JACKSON	746	152	426.286	7578
40	JASPER	0	0	0	0
41	JEFFERSON	22	6	12.571	223
42	JERSEY	8	4	4.571	81
43	JODAVIESS	143	27	81.714	1453
44	JOHNSON	0	0	0	0
45	KANE	10936	3236	6249.143	111096
46	KANKAKEE	2064	389	1179.429	20968
47	KENDALL	537	117	306.857	5455
48	KNOX	416	81	237.714	4226
49	LAKE	25394	7137	14510.857	257971
50	LASALLE	940	164	537.143	9549
51	LAWRENCE	28	8	16	284
52	LEE	344	59	196.571	3495
53	LIVINGSTON	227	50	129.714	2306
54	LOGAN	30	6	17.143	305
55	MACON	454	99	259.429	4612
56	MACOUPIN	50	11	28.571	508
57	MADISON	382	66	218.286	3881
58	MARION	33	5	18.857	335
59	MARSHALL	56	17	32	569
60	MASON	38	12	21.714	386
61	MASSAC	0	0	0	0
62	MCDONOUGH	459	75	262.286	4663
63	MCHENRY	672	149	384	6827
64	MCLEAN	604	128	345.143	6136
65	MENARD	8	1	4.571	81
66	MERCER	66	2	37.714	670
67	MONROE	37	1	21.143	376
68	MONTGOMERY	36	7	20.571	366
69	MORGAN	2236	759	1277.714	22715
70	MOULTRIE	10	3	5.714	102
71	OGLE	74	29	42.286	752
72	PEORIA	2043	494	1167.429	20754
73	PERRY	1	1	0.571	10
74	PIATT	12	7	6.857	122
75	PIKE	7	2	4	71
76	POPE	0	0	0	0
77	PULASKI	0	0	0	0
78	PUTNAM	0	0	0	0
79	RANDOLPH	18	4	10.286	183
80	RICHLAND	42	6	24	427
81	ROCKISLAND	647	161	369.714	6573
82	SALINE	12	2	6.857	122
83	SANGAMON	9911	2505	5663.429	100683
84	SCHUYLER	0	0	0	0
85	SCOTT	9	4	5.143	91
86	SHELBY	7	1	4	71
87	STARK	24	6	13.714	244
88	SAINTCLAIR	235	59	134.286	2387
89	STEPHENSON	166	37	94.857	1686
90	TAZEWELL	291	44	166.286	2956
91	UNION	53	2	30.286	538
92	VERMILION	318	82	181.714	3230
93	WABASH	3	2	1.714	30
94	WARREN	42	10	24	427
95	WASHINGTON	0	0	0	0
96	WAYNE	2	2	1.143	20
97	WHITE	0	0	0	0
98	WHITESIDE	285	52	162.857	2895
99	WILL	572	198	326.857	5811
100	WILLIAMSON	136	23	77.714	1382
101	WINNEBAGO	3014	844	1722.286	30618
102	WOODFORD	69	13	39.429	701
	TOTALS	342056	99353	195460.57	1179252

Exhibit F-11

DATA SOURCE: CMS - DESTINATION SPRINGFIELD

	SOURCE COUNTY	TERMS	BPS/TERM	BPSPEAK
1	ADAMS	28	45	1,260
2	ALEXANDER	13	45	585
3	BOND	0	0	0
4	BOONE	0	0	0
5	BROWN	0	0	0
6	BUREAU	0	0	0
7	CALHOUN	0	0	0
8	CARROLL	0	0	0
9	CASS	0	0	0
10	CHAMPAIGN	186	45	8,370
11	CHRISTIAN	0	0	0
12	CLARK	0	0	0
13	CLAY	0	0	0
14	CLINTON	3	45	135
15	COLES	16	45	720
16	COOK	3,989	45	179,505
17	CRAWFORD	0	0	0
18	CUMBERLAND	6	45	270
19	DEKALB	14	45	630
20	DEWITT	0	0	0
21	DOUGLAS	0	0	0
22	DUPAGE	58	45	2,610
23	EDGAR	26	45	1,170
24	EDWARDS	0	0	0
25	EFFINGHAM	41	45	1,845
26	FAYETTE	8	45	360
27	FORD	0	0	0
28	FRANKLIN	17	45	765
29	FULTON	6	45	270
30	GALLATIN	0	0	0
31	GREENE	0	0	0
32	GRUNDY	7	45	315
33	HAMILTON	0	0	0
34	HANCOCK	0	0	0
35	HARDIN	0	0	0
36	HENDERSON	0	0	0
37	HENRY	0	0	0
38	IROQUOIS	0	0	0
39	JACKSON	53	45	2,385
40	JASPER	0	0	0
41	JEFFERSON	103	45	4,635
42	JERSEY	9	45	405
43	JODAVIESS	0	0	0
44	JOHNSON	24	45	1,080
45	KANE	408	45	18,360
46	KANKAKEE	58	45	2,610
47	KENDALL	2	45	90
48	KNOX	37	45	1,665
49	LAKE	443	45	19,935
50	LASALLE	59	45	2,655
51	LAWRENCE	0	0	0
52	LEE	45	45	2,025
53	LIVINGSTON	44	45	1,980
54	LOGAN	64	45	2,880
55	MACON	50	45	2,250
56	MACOUPIN	9	45	405
57	MADISON	61	45	2,745
58	MARION	54	45	2,430
59	MARSHALL	0	0	0
60	MASON	0	0	0
61	MASSAC	0	0	0
62	MCDONOUGH	6	45	270
63	MCHENRY	17	45	765
64	MCLEAN	31	45	1,395
65	MENARD	0	0	0
66	MERCER	0	0	0
67	MONROE	0	0	0
68	MONTGOMERY	27	45	1,215
69	MORGAN	49	45	2,205
70	MOULTRIE	0	0	0
71	OGLE	0	0	0
72	PEORIA	282	45	12,690
73	PERRY	2	45	90
74	PIATT	0	0	0
75	PIKE	0	0	0
76	POPE	0	0	0
77	PULASKI	6	45	270
78	PUTNAM	0	0	0
79	RANDOLPH	83	45	3,735
80	RICHLAND	18	45	810
81	ROCKISLAND	56	45	2,520
82	SAINTCLAIR	236	45	10,620
83	SALINE	29	45	1,305
84	SANGAMON	4,118	45	185,310
85	SCHUYLER	0	0	0
86	SCOTT	0	0	0
87	SHELBY	0	0	0
88	STARK	0	0	0
89	STEPHENSON	18	45	810
90	TAZEWELL	33	45	1,485
91	UNION	43	45	1,935
92	VERMILION	45	45	2,025
93	WABASH	0	0	0
94	WARREN	0	0	0
95	WASHINGTON	0	0	0
96	WAYNE	0	0	0
97	WHITE	5	45	225
98	WHITESIDE	24	45	1,080
99	WILL	91	45	4,095
100	WILLIAMSON	47	45	2,115
101	WINNEBAGO	222	45	9,990
102	WOODFORD	0	0	0
	TOTALS	11,429	2,475	514,305

Exhibit F-12

	DATA SOURCE: PUBLIC AID - DESTINATION SPRINGFIELD		
	SOURCE COUNTY	REGION	BPSPEAK
1	ADAMS	1	427
2	ALEXANDER	4	73
3	BOND	4	97
4	BOONE	7	171
5	BROWN	1	30
6	BUREAU	5	233
7	CALHOUN	4	35
8	CARROLL	7	112
9	CASS	1	90
10	CHAMPAIGN	2	1,004
11	CHRISTIAN	1	217
12	CLARK	5	101
13	CLAY	3	91
14	CLINTON	4	195
15	COLES	2	316
16	COOK	8	31,335
17	CRAWFORD	3	124
18	CUMBERLAND	5	60
19	DEKALB	6	445
20	DEWITT	2	108
21	DOUGLAS	2	118
22	DUPAGE	8	3,926
23	EDGAR	2	130
24	EDWARDS	5	47
25	EFFINGHAM	4	185
26	FAYETTE	4	132
27	FORD	2	91
28	FRANKLIN	5	258
29	FULTON	3	261
30	GALLATIN	5	45
31	GREENE	4	99
32	GRUNDY	6	182
33	HAMILTON	3	55
34	HANCOCK	5	142
35	HARDIN	3	32
36	HENDERSON	5	54
37	HENRY	7	346
38	IROQUOIS	6	197
39	JACKSON	4	367
40	JASPER	5	68
41	JEFFERSON	3	217
42	JERSEY	4	123
43	JODAVIESS	7	140
44	JOHNSON	3	57
45	KANE	6	1,661
46	KANKAKEE	6	614
47	KENDALL	6	222
48	KNOX	5	367
49	LAKE	8	2,627
50	LASALLE	6	651
51	LAWRENCE	3	106
52	LEE	7	217
53	LIVINGSTON	6	247
54	LOGAN	1	190
55	MACON	2	784
56	MACOUPIN	4	295
57	MADISON	4	1,477
58	MARION	4	260
59	MARSHALL	3	86
60	MASON	1	116
61	MASSAC	3	89
62	MCDONOUGH	5	222
63	MCHENRY	7	881
64	MCLEAN	6	711
65	MENARD	1	70
66	MERCER	5	115
67	MONROE	4	120
68	MONTGOMERY	4	189
69	MORGAN	1	224
70	MOULTRIE	2	87
71	OGLE	7	276
72	PEORIA	5	1,196
73	PERRY	4	130
74	PIATT	2	99
75	PIKE	1	113
76	POPE	5	26
77	PULASKI	4	53
78	PUTNAM	5	36
79	RANDOLPH	4	212
80	RICHLAND	5	105
81	ROCKISLAND	6	990
82	SALINE	5	163
83	SANGAMON	1	1,050
84	SCHUYLER	1	50
85	SCOTT	1	37
86	SHELBY	4	143
87	STARK	5	44
88	SAINTCLAIR	4	1,583
89	STEPHENSON	7	295
90	TAZEWELL	6	788
91	UNION	4	101
92	VERMILION	2	568
93	WABASH	3	82
94	WARREN	5	131
95	WASHINGTON	4	92
96	WAYNE	3	108
97	WHITE	3	107
98	WHITESIDE	7	394
99	WILL	6	1,935
100	WILLIAMSON	5	337
101	WINNEBAGO	7	1,497
102	WOODFORD	5	199
	TOTALS		68,104

Exhibit F-13

	DATA SOURCE STATE LOTTERY - DESTINATION SPRINGFIELD					
	SOURCE COUNTY	TERMS	TRANSHR	BYTETRAN	BPSTERM	BPSPEAK
1	ADAMS	7	307	50	34	238
2	ALEXANDER	5	307	50	34	170
3	BOND	3	307	50	34	102
4	BOONE	5	307	50	34	170
5	BROWN	1	307	50	34	34
6	BUREAU	5	307	50	34	170
7	CALHOUN	2	307	50	34	68
8	CARLK	7	307	50	34	238
9	CARROLL	3	307	50	34	102
10	CASS	3	307	50	34	102
11	CHAMPAIGN	29	307	50	34	986
12	CHRISTIAN	5	307	50	34	170
13	CLAY	2	307	50	34	68
14	CLINTON	7	307	50	34	238
15	COLES	8	307	50	34	272
16	COOK	1,914	307	50	34	65,076
17	CRAWFORD	4	307	50	34	136
18	CUMBERLAND	2	307	50	34	68
19	DEKALB	15	307	50	34	510
20	DEWITT	3	307	50	34	102
21	DOUGLAS	7	307	50	34	238
22	DUPAGE	124	307	50	34	4,216
23	EDGAR	4	307	50	34	136
24	EDWARDS	3	307	50	34	102
25	EFFINGHAM	8	307	50	34	272
26	FAYETTE	5	307	50	34	170
27	FORD	3	307	50	34	102
28	FRANKLIN	8	307	50	34	272
29	FULTON	8	307	50	34	272
30	GALLATIN	3	307	50	34	102
31	GREENE	4	307	50	34	136
32	GRUNDY	8	307	50	34	272
33	HAMILTON	1	307	50	34	34
34	HANCOCK	5	307	50	34	170
35	HARDIN	1	307	50	34	34
36	HENDERSON	2	307	50	34	68
37	HENRY	12	307	50	34	408
38	IROQUOIS	7	307	50	34	238
39	JACKSON	7	307	50	34	238
40	JASPER	1	307	50	34	34
41	JEFFERSON	6	307	50	34	204
42	JERSEY	2	307	50	34	68
43	JODAVIES	12	307	50	34	408
44	JOHNSON	1	307	50	34	34
45	KANE	57	307	50	34	1,938
46	KANKAKEE	23	307	50	34	782
47	KENDALL	7	307	50	34	238
48	KNOX	14	307	50	34	476
49	LAKE	105	307	50	34	3,570
50	LASALLE	26	307	50	34	884
51	LAWRENCE	5	307	50	34	170
52	LEE	5	307	50	34	170
53	LIVINGSTON	7	307	50	34	238
54	LOGAN	4	307	50	34	136
55	MACON	24	307	50	34	816
56	MACOUPIN	12	307	50	34	408
57	MADISON	70	307	50	34	2,380
58	MARION	9	307	50	34	306
59	MARSHALL	3	307	50	34	102
60	MASON	4	307	50	34	136
61	MASSAC	5	307	50	34	170
62	MCDONOUGH	5	307	50	34	170
63	MCHENRY	30	307	50	34	1,020
64	MCLEAN	22	307	50	34	748
65	MENARD	3	307	50	34	102
66	MERCER	2	307	50	34	68
67	MONROE	10	307	50	34	340
68	MONTGOMERY	6	307	50	34	204
69	MORGAN	5	307	50	34	170
70	MOULTRIE	11	307	50	34	374
71	OGLE	9	307	50	34	306
72	PEORIA	46	307	50	34	1,564
73	PERRY	4	307	50	34	136
74	PIATT	3	307	50	34	102
75	PIKE	5	307	50	34	170
76	POPE	1	307	50	34	34
77	PULASKI	2	307	50	34	68
78	PUTNAM	1	307	50	34	34
79	RANDOPH	8	307	50	34	272
80	RICHLAND	2	307	50	34	68
81	ROCKISLAND	48	307	50	34	1,632
82	SAINTCLAIR	95	307	50	34	3,230
83	SALINE	6	307	50	34	204
84	SANGAMON	41	307	50	34	1,394
85	SCHUYLER	1	307	50	34	34
86	SCOTT	1	307	50	34	34
87	SHELBY	2	307	50	34	68
88	STARK	1	307	50	34	34
89	STEPHENSON	6	307	50	34	204
90	TAZEWELL	21	307	50	34	714
91	UNION	2	307	50	34	68
92	VERMILION	20	307	50	34	680
93	WABASH	3	307	50	34	102
94	WARREN	2	307	50	34	68
95	WASHENGTON	5	307	50	34	170
96	WAYNE	3	307	50	34	102
97	WHITE	6	307	50	34	204
98	WHITESIDE	15	307	50	34	510
99	WILL	76	307	50	34	2,584
100	WILLIAMSON	9	307	50	34	306
101	WINNEBAGO	64	307	50	34	2,176
102	WOODFORD	4	307	50	34	136
	TOTALS	3,258				110,772

Exhibit F-14

	DATA SOURCE: STATE POLICE - DESTINATION SPRINGFIELD												
	SOURCE COUNTY	DROPS	TRANSIR	BYTETRAN	BPSDROP	BPSPEAK							
1	ADAMS	8	159	215	76	608							
2	ALEXANDER	2	159	215	76	152							
3	BOND	1	159	215	76	76							
4	BOONE	1	159	215	76	76							
5	BROWN	0	159	215	76	0							
6	BUREAU	1	159	215	76	76							
7	CALHOUN	0	159	215	76	0							
8	CARROLL	0	159	215	76	0							
9	CASS	0	159	215	76	0							
10	CHAMPAIGN	19	159	215	76	1,444							
11	CHRISTIAN	1	159	215	76	76							
12	CLARK	1	159	215	76	76							
13	CLAY	0	159	215	76	0							
14	CLINTON	2	159	215	76	152							
15	COLES	6	159	215	76	456							
16	COOK	259	159	215	76	19,684							
17	CRAWFORD	0	159	215	76	0							
18	CUMBERLAND	0	159	215	76	0							
19	DEKALB	4	159	215	76	304							
20	DEWITT	2	159	215	76	152							
21	DOUGLAS	1	159	215	76	76							
22	DUPAGE	84	159	215	76	6,384							
23	EDGAR	2	159	215	76	152							
24	EDWARDS	1	159	215	76	76							
25	EFFINGHAM	4	159	215	76	304							
26	FAYETTE	1	159	215	76	76							
27	FORD	0	159	215	76	0							
28	FRANKLIN	3	159	215	76	228							
29	FULTON	3	159	215	76	228							
30	GALLATIN	0	159	215	76	0							
31	GREENE	0	159	215	76	0							
32	GRUNDY	3	159	215	76	228							
33	HAMILTON	0	159	215	76	0							
34	HANCOCK	1	159	215	76	76							
35	HARDIN	0	159	215	76	0							
36	HENDERSON	0	159	215	76	0							
37	HENRY	3	159	215	76	228							
38	IROQUOIS	3	159	215	76	228							
39	JACKSON	5	159	215	76	380							
40	JASPER	0	159	215	76	0							
41	JEFFERSON	3	159	215	76	228							
42	JERSEY	1	159	215	76	76							
43	JODAVIESS	1	159	215	76	76							
44	JOHNSON	1	159	215	76	76							
45	KANE	29	159	215	76	2,204							
46	KANKAKEE	8	159	215	76	608							
47	KENDALL	2	159	215	76	152							
48	KNOX	2	159	215	76	152							
49	LAKE	36	159	215	76	2,736							
50	LASALLE	4	159	215	76	304							
51	LAWRENCE	0	159	215	76	0							
52	LEE	1	159	215	76	76							
53	LIVINGSTON	5	159	215	76	380							
54	LOGAN	2	159	215	76	152							
55	MACON	4	159	215	76	304							
56	MACOUPIN	1	159	215	76	76							
57	MADISON	27	159	215	76	2,052							
58	MARION	3	159	215	76	228							
59	MARSHALL	0	159	215	76	0							
60	MASON	3	159	215	76	228							
61	MASSAC	1	159	215	76	76							
62	MCDONOUGH	7	159	215	76	532							
63	MCHENRY	10	159	215	76	760							
64	MCLEAN	5	159	215	76	380							
65	MENARD	1	159	215	76	76							
66	MERCER	1	159	215	76	76							
67	MONROE	4	159	215	76	304							
68	MONTGOMERY	3	159	215	76	228							
69	MORGAN	2	159	215	76	152							
70	MOULTRIE	2	159	215	76	152							
71	OGLE	4	159	215	76	304							
72	PEORIA	17	159	215	76	1,292							
73	PERRY	3	159	215	76	228							
74	PIATT	1	159	215	76	76							
75	PIKE	3	159	215	76	228							
76	POPE	0	159	215	76	0							
77	PULASKI	0	159	215	76	0							
78	PUTNAM	0	159	215	76	0							
79	RANDOLPH	1	159	215	76	76							
80	RICHLAND	2	159	215	76	152							
81	ROCKISLAND	15	159	215	76	1,140							
82	SAINTCLAIR	26	159	215	76	1,976							
83	SALINE	1	159	215	76	76							
84	SANGAMON	171	159	215	76	12,996							
85	SCHUYLER	0	159	215	76	0							
86	SCOTT	0	159	215	76	0							
87	SHELBY	2	159	215	76	152							
88	STARK	0	159	215	76	0							
89	STEPHENSON	2	159	215	76	152							
90	TAZEWELL	17	159	215	76	1,292							
91	UNION	2	159	215	76	152							
92	VERMILION	5	159	215	76	380							
93	WABASH	1	159	215	76	76							
94	WARREN	2	159	215	76	152							
95	WASHINGTON	0	159	215	76	0							
96	WAYNE	1	159	215	76	76							
97	WHITE	2	159	215	76	152							
98	WHITESIDE	6	159	215	76	456							
99	WILL	51	159	215	76	3,876							
100	WILLIAMSON	2	159	215	76	152							
101	WINNEBAGO	21	159	215	76	1,596							
102	WOODFORD	5	159	215	76	380							
	TOTALS	953				72,428							

Exhibit F-15

	TOTAL BPS FOR VOICE AND DATA SYSTEMS COMBINED (CURRENT TRAFFIC)			
	COUNTY	BPSVOICE	BPSDATA	COMBINED
1	ADAMS	943,701.749	2,533	946,234.749
2	ALEXANDER	118,192.835	980	119,172.835
3	BOND	73,169.044	275	73,444.044
4	BOONE	122,130.298	417	122,547.298
5	BROWN	10,327.585	64	10,391.585
6	BUREAU	288,603.732	479	289,082.732
7	CALHOUN	53,829.234	103	53,932.234
8	CARROLL	127,963.259	350	128,313.259
9	CASS	230,251.153	192	230,443.153
10	CHAMPAIGN	12,025,183.243	14,225	12,039,408.243
11	CHRISTIAN	568,597.313	1,279	569,876.313
12	CLARK	61,296.342	347	61,643.342
13	CLAY	90,415.192	159	90,574.192
14	CLINTON	182,932.663	720	183,652.663
15	COLES	865,343.064	1,764	867,107.064
16	COOK	32,042,507.157	333,488	32,375,995.157
17	CRAWFORD	87,057.866	260	87,317.866
18	CUMBERLAND	60,362.954	398	60,760.954
19	DEKALB	1,086,174.173	1,889	1,088,063.173
20	DEWITT	126,329.111	362	126,691.111
21	DOUGLAS	243,996.376	432	244,428.376
22	DUPAGE	8,247,041.896	17,136	8,264,177.896
23	EDGAR	181,266.923	1,588	182,854.923
24	EDWARDS	34,862.779	225	35,087.779
25	EFFINGHAM	299,132.354	2,606	301,738.354
26	FAYETTE	229,441.259	738	230,179.259
27	FORD	146,168.643	193	146,361.643
28	FRANKLIN	281,076.312	1,523	282,599.312
29	FULTON	382,020.127	1,031	383,051.127
30	GALLATIN	31,278.567	147	31,425.567
31	GREENE	138,434.442	235	138,669.442
32	GRUNDY	195,506.124	997	196,503.124
33	HAMILTON	35,506.099	89	35,595.099
34	HANCOCK	120,725.908	388	121,113.908
35	HARDIN	18,058.914	66	18,124.914
36	HENDERSON	48,694.161	122	48,816.161
37	HENRY	256,655.996	982	257,637.996
38	IROQUOIS	283,468.659	663	284,131.659
39	JACKSON	1,111,602.549	3,370	1,114,972.549
40	JASPER	73,347.106	102	73,449.106
41	JEFFERSON	805,499.936	7,562	813,061.936
42	JERSEY	148,560.989	672	149,232.989
43	JODAVIESS	175,172.614	624	175,796.614
44	JOHNSON	222,140.725	1,247	223,387.725
45	KANE	2,355,599.797	32,806	2,388,405.797
46	KANKAKEE	1,167,462.262	4,614	1,172,076.262
47	KENDALL	175,867.63	702	176,569.63
48	KNOX	1,509,191.596	2,660	1,511,851.596
49	LAKE	3,010,855.773	28,868	3,039,723.773
50	LASALLE	1,019,972.515	4,494	1,024,466.515
51	LAWRENCE	87,382.398	276	87,658.398
52	LEE	566,153.271	2,488	568,641.271
53	LIVINGSTON	524,107.708	2,845	526,952.708
54	LOGAN	833,780.172	3,358	837,138.172
55	MACON	1,800,770.683	4,154	1,804,924.683
56	MACOUPIN	659,515.099	1,184	660,699.099
57	MADISON	1,592,314.87	8,654	1,600,968.87
58	MARION	537,235.459	3,224	540,459.459
59	MARSHALL	99,958.731	188	100,146.731
60	MASON	230,776.723	480	231,256.723
61	MASSAC	74,220.183	335	74,555.183
62	MCDONOUGH	514,802.542	1,194	515,996.542
63	MCHENRY	761,130.954	3,426	764,556.954
64	MCLEAN	2,169,815.274	3,234	2,173,049.274
65	MENARD	386,460.184	248	386,708.184
66	MERCER	78,186.367	259	78,445.367
67	MONROE	61,732.881	764	62,496.881
68	MONTGOMERY	495,689.617	1,836	497,525.617
69	MORGAN	1,188,907.222	2,751	1,191,658.222
70	MOULTRIE	92,517.47	613	93,130.47
71	OGLE	238,358.709	886	239,244.709
72	PEORIA	4,349,953.824	19,828	4,369,781.824
73	PERRY	146,576.462	584	147,160.462
74	PIATT	280,025.173	277	280,302.173
75	PIKE	154,192.912	511	154,703.912
76	POPE	24,796.543	60	24,856.543
77	PULASKI	69,524.521	391	69,915.521
78	PUTNAM	32,091.333	70	32,161.333
79	RANDOLPH	484,221.862	4,295	488,516.862
80	RICHLAND	154,336.51	1,135	155,471.51
81	ROCKISLAND	1,363,433.644	6,282	1,369,715.644
82	SALINE	315,066.014	5,249	320,315.014
83	SANGAMON	54,481,144.292	199,750	54,680,894.292
84	SCHUYLER	48,111.152	71	48,182.152
85	SCOTT	79,909.545	177	80,086.545
86	SHELBY	167,320.663	264	167,584.663
87	STARK	70,604.38	7,578	78,182.38
88	SAINTCLAIR	3,150,022.566	15,989	3,166,011.566
89	STEPHENSON	396,084.138	1,461	397,545.138
90	TAZEWELL	834,182.248	4,279	838,461.248
91	UNION	189,319.912	2,256	191,575.912
92	VERMILION	1,081,736.988	3,653	1,085,389.988
93	WABASH	70,805.417	260	71,065.417
94	WARREN	203,676.864	351	204,027.864
95	WASHINGTON	94,878.225	262	95,140.225
96	WAYNE	64,708.236	286	64,994.236
97	WHITE	136,340.78	688	137,028.78
98	WHITESIDE	492,656.823	2,440	495,096.823
99	WILL	2,010,516.008	12,490	2,023,006.008
100	WILLIAMSON	1,389,439.284	2,910	1,392,349.284
101	WINNEBAGO	2,515,046.969	19,588	2,534,634.969
102	WOODFORD	201,778.495	715	202,493.495
	TOTALS	160,159,295.3	833,713	160,993,008.3

	TOTAL TRAFFIC PROJECTIONS FOR 2 AND 5 YEARS, VOICE AND DATA COMBINED			
	COUNTY	BPS/CURRENT	BPS/2YEARS	BPS/5YEARS
1	ADAMS	946,234.749	1,042,180.924	1,215,417.239
2	ALEXANDER	119,172.835	131,617.119	154,048.829
3	BOND	73,444.044	80,999.948	94,699.376
4	BOONE	122,547.298	135,131.328	157,912.781
5	BROWN	10,391.585	11,485.344	13,464.309
6	BUREAU	289,082.732	318,357.105	371,227.777
7	CALHOUN	53,932.234	59,419.157	69,300.42
8	CARROLL	128,313.259	141,467.585	165,146.972
9	CASS	230,443.153	253,650.268	295,457.476
10	CHAMPAIGN	12,039,408.243	13,249,865.567	15,431,919.551
11	CHRISTIAN	569,876.313	628,101.044	732,783.561
12	CLARK	61,643.342	68,095.976	79,786.318
13	CLAY	90,574.192	99,758.711	116,337.446
14	CLINTON	183,652.663	202,528.929	236,667.809
15	COLES	867,107.064	954,826.37	1,113,117.122
16	COOK	32,375,995.157	35,800,953.873	41,986,352.161
17	CRAWFORD	87,317.866	96,269.653	112,430.068
18	CUMBERLAND	60,760.954	67,042.249	78,335.581
19	DEKALB	1,088,063.173	1,198,089.39	1,396,441.941
20	DEWITT	126,691.111	139,624.022	163,066.262
21	DOUGLAS	244,428.376	269,242.014	313,973.361
22	DUPAGE	8,264,177.896	9,102,172.086	10,616,625.627
23	EDGAR	182,854.923	201,874.615	236,117.661
24	EDWARDS	35,087.779	38,778.057	45,482.357
25	EFFINGHAM	301,738.354	333,159.589	389,739.413
26	FAYETTE	230,179.259	253,633.385	295,899.812
27	FORD	146,361.643	161,161.507	187,835.863
28	FRANKLIN	282,599.312	311,714.943	364,295.679
29	FULTON	383,051.127	422,035.14	492,449.763
30	GALLATIN	31,425.567	34,704.424	40,605.566
31	GREENE	138,669.442	152,740.886	178,099.086
32	GRUNDY	196,503.124	216,802.736	253,515.839
33	HAMILTON	35,595.099	39,223.709	45,785.807
34	HANCOCK	121,113.908	133,537.499	156,007.162
35	HARDIN	18,124.914	19,992.805	23,367.41
36	HENDERSON	48,816.161	53,802.577	62,797.526
37	HENRY	257,637.996	284,180.596	332,255.675
38	IROQUOIS	284,131.659	313,052.525	365,352.884
39	JACKSON	1,114,972.549	1,228,025.804	1,431,683.263
40	JASPER	73,449.106	80,870.817	94,270.296
41	JEFFERSON	813,061.936	897,863.93	1,051,886.918
42	JERSEY	149,232.989	164,492.088	192,034.066
43	JODAVIESS	175,796.614	193,943.875	226,631.946
44	JOHNSON	223,387.725	246,229.798	287,288.128
45	KANE	2,388,405.797	2,643,329.777	3,108,576.74
46	KANKAKEE	1,172,076.262	1,291,790.488	1,507,574.695
47	KENDALL	176,569.63	194,736.393	227,627.566
48	KNOX	1,511,851.596	1,664,456.756	1,939,145.243
49	LAKE	3,039,723.773	3,357,893.35	3,930,700.389
50	LASALLE	1,024,466.515	1,129,386.767	1,318,298.819
51	LAWRENCE	87,658.398	96,670.638	112,913.469
52	LEE	568,641.271	626,590.598	730,786.187
53	LIVINGSTON	526,952.708	580,987.479	678,374.866
54	LOGAN	837,138.172	922,237.189	1,075,232.62
55	MACON	1,804,924.683	1,987,750.751	2,317,073.474
56	MACOUPIN	660,699.099	727,573.609	848,035.327
57	MADISON	1,600,968.87	1,766,706.357	2,066,523.034
58	MARION	540,459.459	595,998.005	695,900.388
59	MARSHALL	100,146.731	110,321.604	128,668.176
60	MASON	231,256.723	254,731.395	297,204.205
61	MASSAC	74,555.183	82,291.201	96,283.834
62	MCDONOUGH	515,996.542	568,321.796	662,988.254
63	MCHENRY	764,556.954	843,358.049	985,993.621
64	MCLEAN	2,173,049.274	2,392,308.801	2,787,354.551
65	MENARD	386,708.184	425,574.202	495,612.036
66	MERCER	78,445.367	86,475.004	101,054.55
67	MONROE	62,496.881	69,364.169	81,930.088
68	MONTGOMERY	497,525.617	548,181.579	639,443.71
69	MORGAN	1,191,658.222	1,312,023.944	1,528,605.244
70	MOULTRIE	93,130.47	102,988.217	120,783.362
71	OGLE	239,244.709	263,841.58	308,454.148
72	PEORIA	4,369,781.824	4,816,305.206	5,622,025.895
73	PERRY	147,160.462	162,266.108	189,673.871
74	PIATT	280,302.173	308,544.69	359,482.221
75	PIKE	154,703.912	170,559.203	199,300.927
76	POPE	24,856.543	27,394.197	31,969.575
77	PULASKI	69,915.521	77,108.973	90,036.387
78	PUTNAM	32,161.333	35,435.466	41,343.906
79	RANDOLPH	488,516.862	539,176.048	629,972.983
80	RICHLAND	155,471.51	171,535.161	200,511.733
81	ROCKISLAND	1,369,715.644	1,510,614.008	1,764,940.064
82	SALINE	320,315.014	372,732.615	446,789.498
83	SANGAMON	54,680,894.292	59,937,928.721	69,753,314.694
84	SCHUYLER	48,182.152	348,561.267	513,774.275
85	SCOTT	80,086.545	88,037.5	102,555.218
86	SHELBY	167,584.663	184,368.729	214,833.449
87	STARK	78,182.38	78,143.818	91,367.606
88	SAINTCLAIR	3,166,011.566	3,477,847.823	4,060,075.884
89	STEPHENSON	397,545.138	438,076.552	511,189.697
90	TAZEWELL	838,461.248	924,840.473	1,081,462.277
91	UNION	191,575.912	211,652.903	247,694.487
92	VERMILION	1,085,389.988	1,195,950.687	1,395,171.345
93	WABASH	71,065.417	78,374.959	91,617.934
94	WARREN	204,027.864	224,670.55	262,022.386
95	WASHINGTON	95,140.225	104,892.048	122,456.128
96	WAYNE	64,994.236	71,712.06	83,910.542
97	WHITE	137,028.78	151,185.858	176,764.198
98	WHITESIDE	495,096.823	546,048.505	638,081.733
99	WILL	2,023,006.008	2,232,999.609	2,613,972.49
100	WILLIAMSON	1,392,349.284	1,532,965.212	1,786,047.284
101	WINNEBAGO	2,534,634.969	2,798,423.666	3,276,794.12
102	WOODFORD	202,493.495	223,230.345	260,955.474
	TOTALS	160,993,008.3	177,520,172.83	207,319,160.98

Exhibit F-17